

An aerial photograph showing a vast, brown, muddy floodwater covering an urban area. Several small boats are visible, some with people inside. In the background, there are some structures, including a building with a sign that says "DE W A - 1501". The water is very murky, and the overall scene depicts a severe flooding event.

A **DownToEarth** PUBLICATION

STATE OF INDIA'S
URBAN WATER BODIES

WHY URBAN INDIA FLOODS

Indian cities grow at the
cost of their wetlands

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Contents

04	An urban nightmare			
06	Shrinking water bodies push urban floods			
09	Jammu and Kashmir	Srinagar washed out Going dry	10 15	
17	Delhi-NCR	Aravallis undermined Failed promise	18 20	
21	Rajasthan	Sunset over Udaisagar New lease of life	22 25	Lake in transition 27
29	Gujarat	Real estate on water Left to dry	30 33	
36	Assam	Watery grave Who messed it up?	37 40	
45	West Bengal	Everybody loves water body 'Community management of ponds has been a success'	46 51	
54	Maharashtra	Don't plug this hole 'Mithi is a river, not real estate'	55 57	
60	Chhattisgarh	Awaiting disaster	61	
64	Karnataka	Lost lakes Blame game	65 67	Saving city lakes 70
72	Andhra Pradesh & Telangana		Dry cleaning Hussainsagar	73
76	Tamil Nadu	Chennai apart Temple tanks hold key to water recharge	77 82	
84	Getting the act right			

An urban nightmare

Floods ravaging urban India are getting increasingly regular.

The solution lies in rethinking our urban planning



Floods have become a chronic problem in Chennai

SUNITA NARAIN

The memories of unprecedented floods in Mumbai, Srinagar and Chennai are still fresh. Ignored as sporadic or once-in-a-while event, urban floods have become regular, and increasingly devastating.

The floods repeatedly draw our attention to only one fact: our urban sprawls have not paid adequate attention to the natural water bodies that exist in them. A case in point is Chennai, where each of its lakes has a natural flood discharge channel which drains the spill over. But we have built over many of these water bodies, blocking the smooth flow of water. We have forgotten the art of drainage. We only see land for buildings, not for water. And the result is in front our eyes.

An urban water body provides some crucial services such as groundwater recharge and flood management. If you ask the obvious question of how construction was permitted on the wetland, you will get a not-so-obvious response: wetlands are rarely recorded under municipal land laws, so nobody knows about them. Planners see only land, not water, and builders take over.

A number of cities including Chennai are both water-scarce as well as prone to flooding. Both problems are related—excessive construction which leads to poor recharge of groundwater aquifers and blocking of natural drainage systems. The city witnessed severe floods in 2015 when the entire city got completely submerged under water after it rained for a few days.

Delhi-based non-profit Centre for Science and Environment's research shows that Chennai had more than 600 water bodies in the 1980s, but a master plan published in 2008 said that only a fraction of the lakes could be found in a healthy condition. According to records of the state's Water Resources Department, the area of 19 major lakes had shrunk from a total of 1,130 hectares (ha) in the 1980s to around 645 ha in the early 2000s, reducing their storage capacity. The drains that carry surplus water from tanks to other wetlands have also been encroached upon.

The analysis also shows that the stormwater drains constructed to drain flood waters are clogged and require immediate desiltation. Chennai has only 855 km of stormwater drains against 2,847 km of urban roads. Thus, even a marginally heavy rainfall causes havoc in the city. Explaining the problem of pollution, the City Development Plan says: "The waterways of Chennai... receive flood discharge only during the monsoon season; the rest of the year these act as carriers of wastewater from sewage treatment plants and others."

So Chennai needs to do what all cities must—undertake a detailed survey of the wetlands and then bring every water body and its catchment under legal protection. The Wetlands Conservation and Management Rules issued by the Union Ministry of Environment and Forests and Climate Change are toothless and meaningless. What is needed is to ensure that city development rules include a comprehensive list of water bodies and their catchment. Any change of this land use should not be permitted. Even this will not be enough unless the city values the water this land gives.

The Central government should provide funds for water supply to only those cities that have brought their own water sources under protection. The cities must show they have optimised local water potential before claiming access to water from far away sources. This will reduce the cost of supply. The city can invest the saved money in treating sewage, which pollutes the lakes and ponds in the first place. It is this vicious cycle that needs to be broken.

It is time we realised that a water body is not an ornamental luxury or a wasted land. A city's lake is its lifeline. ■

Wetlands are rarely recorded under municipal land laws, so nobody knows about them. Planners see only land, not water, and builders take over

Shrinking water bodies push urban floods

The role of water bodies has become even more critical today when cities are facing the challenge of rapid unplanned urbanisation



A railway track cuts through Guwahati's Deepor beel, which is one of the most encroached water bodies in Assam

Lakes and wetlands are an important part of urban ecosystem. They perform significant environmental, social and economic functions, ranging from being a source of drinking water, recharging groundwater to acting as sponges, supporting biodiversity and providing livelihoods. Their role becomes even more critical in today's context when cities are facing the challenge of rapid unplanned urbanisation.

Their numbers are declining rapidly. For example, in the 1960s Bangalore had 262 lakes, now only 10 hold water. Similarly, in 2001, 137 lakes were listed in Ahmedabad city, and construction work had started on 65 of them. Another example exhibiting this increasing loss of urban water bodies is Hyderabad. In the last 12 years, Hyderabad has lost 3,245 ha of its wetlands.

The National Disaster Management Guidelines: Management of Urban Flooding report, published by the National Disaster Management Authority (NDMA) in 2010, says that concretisation is a major problem in many cities and towns. According to the Union Ministry of Urban Development (MoUD), 31 per cent of the country was urbanised in 2011. The ministry says almost 50 per cent of the country will be urbanised by 2050. MoUD data also suggests a 54 per cent increase in the number of cities and towns between 2001 and 2011.

Natural streams and watercourses, formed over thousands of years due to the forces of flowing water in the respective watersheds, have been altered because of urbanisation. "As a result of this, the flow of water has increased in proportion to the urbanisation of the watersheds. Ideally, the natural drains should have been widened to accommodate

the higher flows of stormwater. But on the contrary, there have been large scale encroachments on the natural drains and the river flood plains. Consequently, the capacity of natural drains has decreased, resulting in flooding," says the NDMA report.

Threats to urban water bodies

For the last two decades, urban water bodies have been a victim of unplanned urbanisation in India, because of which they face several threats such as encroachment, disposal of sewage, groundwater decline leading to fall in the level of lake, unplanned tourism and absence of administrative framework. Let us discuss these in detail:

Pollution: There has been an explosive increase in the urban population without corresponding expansion of civic facilities such as adequate infrastructure for the disposal of waste. Hence, as more people are migrating to cities, the urban civic services are becoming less adequate. As a result, almost all urban water bodies in India are suffering because of pollution. In many cases the water bodies have been turned into landfills. Guwahati's Deepor beel, for example, is used by the municipal corporation to dump solid waste since 2006. Even the Pallikarni marshland in Chennai is used for solid waste dumping. Adding to the sorry state of urban water bodies is also the misuse of these water bodies by local communities for their cultural or religious festivals such as the immersion of idols. Heavy metal concentration is found in Nagpur lakes, Bhopal lakes and Hussainsagar Lake in Hyderabad after the immersion of idols every year.

Encroachment: This is another major threat to urban water bodies. As more people are migrating to cities, the availability of land is getting scarce. Today, even a small piece of land in urban areas has high economic value. Hence, these urban water bodies are no more acknowledged for their ecosystem services but as real estate. Charkop Lake in Maharashtra, Ousteri Lake in Puducherry, Deepor beel in Guwahati are well known examples of encroachment. Another interesting example of encroachment and pollution, not by some private builder but the government itself is Pallikarni marshland in Chennai. The size of this city wetland is decreasing rapidly. Once a bird sanctuary, it is now the dumping yard of the city. The dumping of solid waste, sewage discharge, and construction of new buildings such as a railway stations and a new road have shrunk this wetland to a great extent. Another example of government encroachment is Sola beel in Guwahati where the state revenue department allotted the lake bed for construction, in spite of Gauhati High Court's order to protect all wetlands in the state.

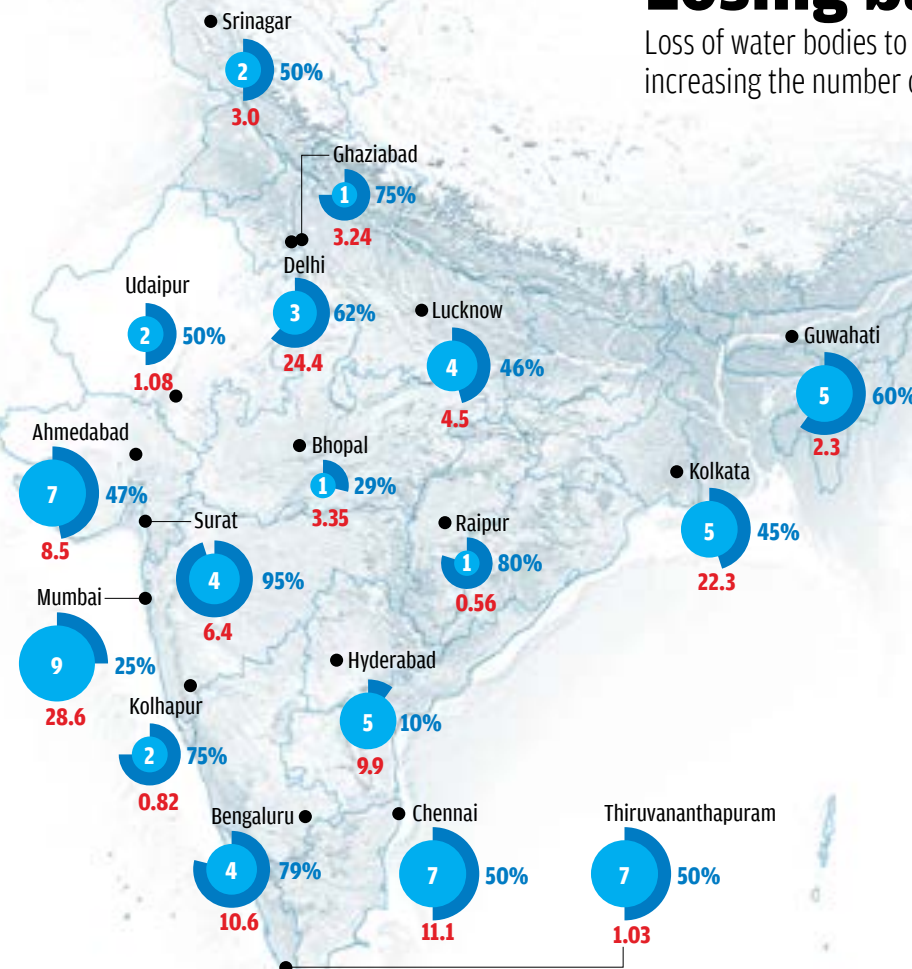
Illegal mining activities: Illegal mining for building material such as sand and quartzite both on the catchment and on the bed of the lake have extremely damaging impact on the water body. For example, the Jaisamand Lake in Jodhpur, once the only source of drinking water for the city, has been suffering from illegal mining in the catchment area for the last 20 years, despite a court order to stop mining in 1999. Badkhal Lake in Faridabad has dried up in the same way. Unmindful sand mining from the catchment of Vembanad Lake on the outskirts of Kochi has lowered the water level in the lake.

Unplanned tourism activities: Using water bodies to attract tourists has become a threat to several urban lakes in India. Tso Moriri and Pongsho

Government data suggests that the number of cities and towns increased by 54 per cent between 2001 and 2011

Losing base

Loss of water bodies to urbanisation is increasing the number of flood events



Population in urban India

2011	2031
377 million	600 million

Metropolitan cities

2011	2031
52 million	87 million

Population in metropolitan area

2011	2031
160 million	255 million

Level of urbanisation

2011	2031
31%	50%

- Number of major flood events after 2000
- Loss in water bodies/water spread due to urbanisation
- X Population projected in 2031 (in million)

Sources: Research articles and documents; personal communication with government officials and researchers; newspaper articles

lakes in Ladakh have become polluted because of unplanned and unregulated tourism. Another example is Ashtamudi Lake in Kerala's Kollam city that has become polluted because of spillage of oil from motor boats.

Absence of administrative framework: The biggest challenge remains government apathy towards water bodies. This can be understood from the fact that the government does not even have data on the total number of urban water bodies in the country. The few cities where water bodies are recorded have done it because of court rulings. A 2010-11 Comptroller and Auditor General of India report on the plight of 22 lakes in 14 states said: "MoEF&CC (Union Ministry of Environment & Climate Change) had not identified wetlands associated with each river/lake and no identifications of risks to these wetlands due to pollution of river water/lake water had been carried out by CPCB (Central Pollution Control Board). Further, CPCB had not identified the major aquatic species, birds, plants and animals facing risks due to pollution of rivers and lakes."

This book highlights how the above reasons have led to the depletion of water bodies in urban areas. It also highlights the need for immediate action to conserve and revive our water bodies. India is urbanising at a phenomenal rate (433 million people will be in living in urban areas by 2021). And this can only be sustained with its water bodies. ■

JAMMU AND KASHMIR



Total number of wetlands

3,651
(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)

38
Most urbanised city
Srinagar

Urban floods (in past decade)

Jammu 1
Srinagar 2

State's level of urbanisation

2011 24.81%
2011 27.21%

Slow decay

Srinagar witnessed its worst floods in 2014 which left hundreds dead and caused losses worth millions. From experts to the administration, all believe the most important reason behind the floods was the collapse of the natural drainage system in the city. Scientists say that since the drainage channels of the city has been blocked and the link between the lakes has been cut off due to

unplanned urbanisation and encroachment, the lakes have lost their power to absorb water the way they used to a century ago and save the city from floods. The city lost half of its water bodies between 1911 and 2004. The story is not much different in Jammu where almost all of the 150 ponds have shrunk in size. Unplanned urbanisation has reduced most wetlands into dumping sites.

ATTEMPTS TO SAVE WETLANDS

2000

Lawyer Syed Mujtaba Hussain and non-profit Green Kashmir files a writ petition in the Supreme Court to save the Dal Lake. The petitioners invoke the extraordinary jurisdiction of the apex court, under Article 32 of the Constitution, urging it to intervene to save the Dal Lake that has turned into a reservoir of sewage, waste and effluents. But nothing happens.

2001

Jammu and Kashmir High Court passes several directions to remove encroachments and to clean up the Dal Lake. The state government also undertakes several drives that at best provide temporary relief.

2015

Jammu and Kashmir High Court appoints a two-person court commission to inspect the Dal Lake on daily basis and submit weekly reports on its encroachment.

See more coverage on www.downtoearth.org.in

Track court cases on www.indiaenvironmentportal.org.in and www.rainwaterharvesting.org

Srinagar washed out

Jammu and Kashmir chief minister pleaded helplessness as the seat of his government went under water during the 2014 floods. As extreme weather events become more frequent and natural drainage systems collapse due to urbanisation, Indian cities have to be ready to deal with floods

When the rains began in Jammu and Kashmir (J&K) on the morning of September 3, 2014, it was just another day for Vijay Gadhia. The 50-year-old employee of Jammu's Power Development Department had gone to Srinagar with his colleagues for official work. He expected the next day to be bright and sunny. A day of rain in the region is usually followed by a day of sunshine. But the rain did not stop. Instead, he heard the news that a bus carrying 70 members of a wedding party was washed away by flash floods in Rajouri, of which 50 could not be traced.

On the night of September 4, the Doodh Ganga, a tributary of the Jhelum flowing through Srinagar, breached its embankment following a cloudburst in its catchment area. On September 5, the water level in the Tawi and Chenab rivers in Jammu rose dramatically. Flood control bunds were washed away, bridges collapsed and land got submerged. Rains continued to lash the region in the next few days triggering landslides that disrupted highways and snapped power lines. Till the afternoon of September 5, Srinagar residents were clicking photographs of the gradually swelling Jhelum to post on social media.

A temple stands amidst the waters of the overflowing Tawi river during heavy rains in Jammu on September 6, 2014



REUTERS

On the night of September 5, the Jhelum too breached its embankment at Padshahi Bagh, following which there was a half-hearted attempt by the state administration to warn the people. Announcements were made from several mosques in the city at 10 pm. Residents were asked to move to the first floor of their houses. But the announcements came late. Most people had gone to bed. Many of those who were awake ignored the words. According to Gadhia, it hardly sounded like a warning. Those who did not have a multi-storey building had no choice. By the time the announcements started, some parts of Srinagar were already submerged in waist-deep water.

Gadhia and his colleagues sensed trouble and fled Srinagar, spent four days in the wilderness without food and water before reaching the Shankaracharya hill on September 12. "After that we reached the Governor House from where we were airlifted to Jammu," Gadhia told *Down To Earth*.

A city under water

In September 2014, rainfall in Srinagar crossed its 10-year-high mark—151.9 mm of rainfall in September 1992—within 24 hours. The city received 156.7 mm of rainfall on September 5 alone. The average monthly rainfall for Srinagar is 56.4 mm. The India Meteorological Department recorded more than 500 mm of rainfall in the first week of September. The floodwater started receding from September 11, but till September 13 more than 70 per cent of Srinagar was still submerged, with tens of thousands of people stranded.

The two distinct water channels flowing through the city—the Jhelum and the flood channel, an artificial outlet created in 1904 to drain out excess water from the Jhelum in case of flood—had merged into a big, brown lake.

Gadhia was lucky to have been saved, unlike hundreds others who lost their lives in the deluge. Hectares of ripe crop and orchards have been lost, and the infrastructural damage is likely to cross ₹6,000 crore.

The then Jammu and Kashmir Chief Minister Omar Abdullah pleaded helplessness. "I had no government for the first 36 hours as the seat of establishment was wiped out. My own residence has no power supply, and my cellphones had no connectivity. My capital city (Srinagar) was taken out. I resumed administrative operations with six officers in a makeshift mini secretariat," he told journalists at a press meet on September 9. According to news reports, the six-storey secretariat was submerged up to the second floor. Abdullah added that his officers could not be located for at least three days after the floods began.

Floods not unprecedented

Jammu and Kashmir has a long history of floods. From 1905 to 1959, the state was hit by flood 14 times. In 2010, the Jammu and Kashmir Flood Control Ministry had prepared a report and issued a warning that the state is likely to face a major flood catastrophe in the next five years and that the government is ill-equipped to save lives and property. The Irrigation and Flood Control Department had proposed a ₹2,200 crore project to put the required infrastructure in place. The report was submitted to the Union Water Resources Ministry, but nothing happened.

"I had no government for the first 36 hours as the seat of establishment was wiped out"

— OMAR ABDULLAH



Srinagar's lost SAVIOURS

The entire city of Srinagar was flooded after Jammu and Kashmir received more than 550 mm of rainfall in one week. Would the city have faced the same catastrophe had its wetlands and other water bodies been in good shape?

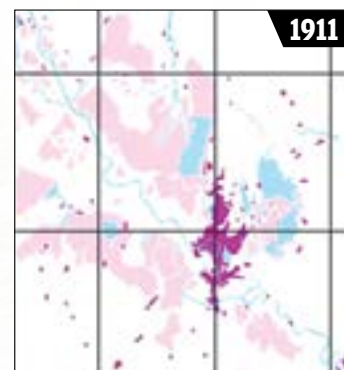
Drains | The central city was the worst-affected as drainage channels that used to drain out floodwater have disappeared as also the wetlands in and around Srinagar because of encroachment

- Worst-affected areas
- Wetlands, water bodies lost to urbanisation

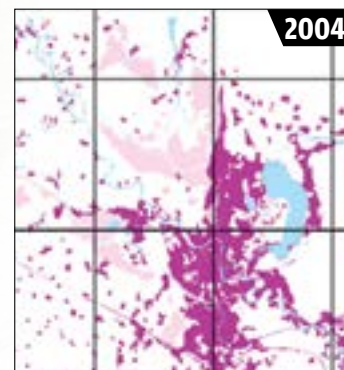
Lakes | Dal Lake in Srinagar, one of the largest freshwater lakes in the world, has been reduced to one-sixth of its original size. Others like Anchar and Wular lakes have also shrunk in size and face heavy pollution

Water bodies turn urban jungles

From 1911-2004, Srinagar lost more than 50 per cent of its water bodies due to urbanisation



Wetland	13,425.90 hectares (ha)
Built-up land	1,745.73 ha
Open water source	4,000.50 ha
Others	50,505.90 ha



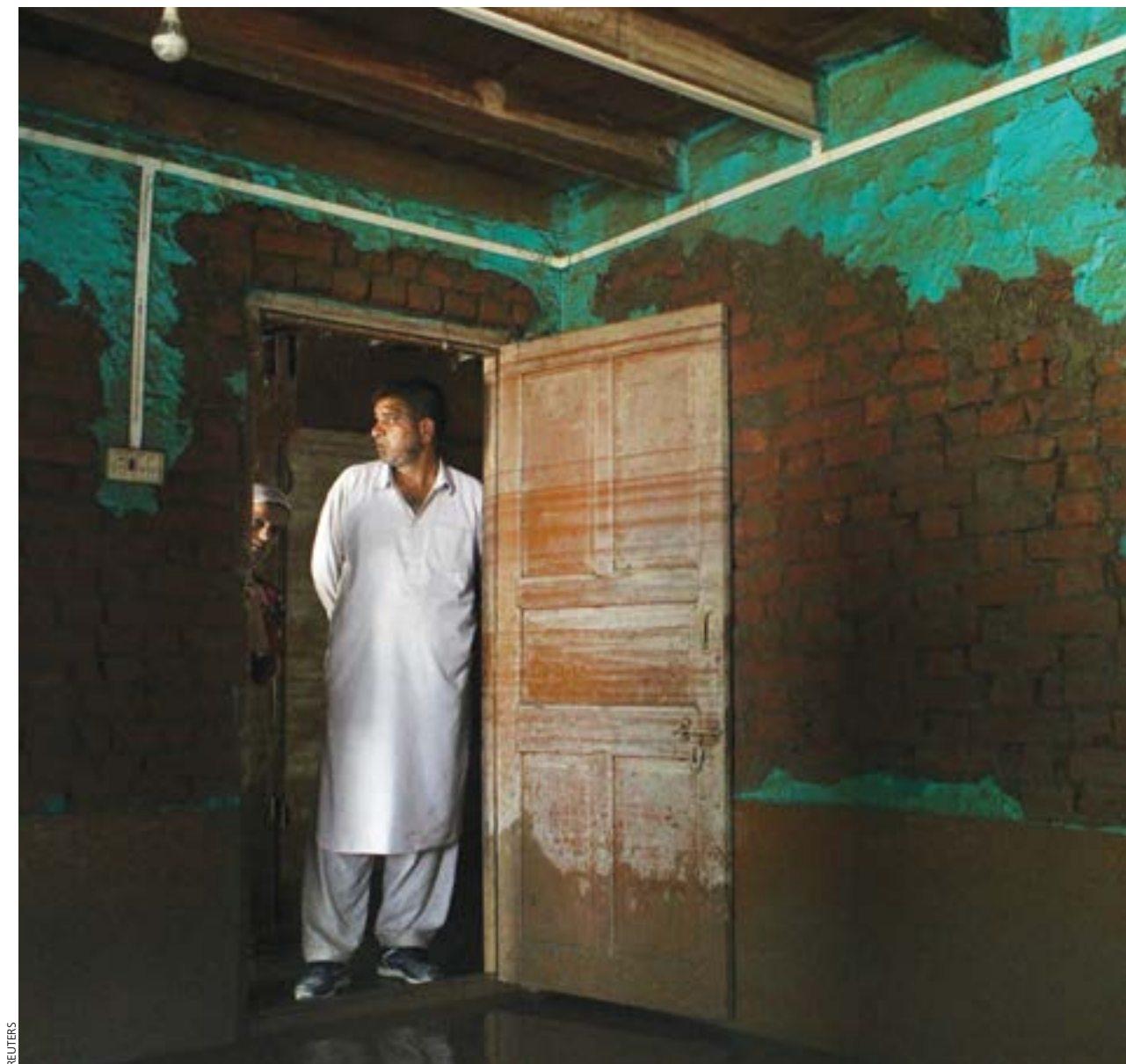
Wetland	6,407.14 ha
Built-up land	10,791.60 ha
Open water source	3,065.88 ha
Others	49,426.70 ha

Source: CSE/DTE data centre based on study "Quantification of loss of spatial extent of lakes and wetlands in the suburbs of Srinagar city during last century using geospatial approach"; Authors: Humayun Rashid and Gowhar Naseem

The Jhelum is one of the most important natural drainage channels of Srinagar, which is otherwise like a bowl having no outlet for water. Silt has accumulated in all of its major tributaries and the flood channels are blocked. The wetlands of Nadru, Nambal, Narkara Nambal and Hokarsar that absorb rainwater have been replaced by residential colonies (see 'Srinagar's lost saviours'). When it rains for two to three days, the city gets flooded with water from the Jhelum. "Srinagar faces flood every 50 years. It has a cycle. But encroachment has killed its flood channels. Bemina used to be a flood basin, but many buildings have come up in its place in the past 10 years," Sharma says.

Abdullah defended himself by saying that the state capital had never been hit by a disaster in recent memory. But the devastating flood could have been averted had his administration and the Union government taken necessary steps to save the drainage channels of Srinagar when an alert was sounded in 2010.

A resident of Padshahi Bagh in Srinagar assesses the damage to his house in the aftermath of the flood



REUTERS

Drainage is the key

The drainage channels of the city have been blocked. The links connecting the lakes have been cut off due to unplanned urbanisation and encroachment. As a result, the lakes have lost their capacity to absorb water the way they used to a century ago, scientists say

Wetlands and lakes act as sponges during floods. The Kashmir Valley is dotted with wetlands. Apart from natural ponds and lakes, the valley has other types of wetlands, such as rivers, streams, riverine wetlands, human-made ponds and tanks. According to a report by the Department of Environment and Remote Sensing, there are 1,230 lakes and water bodies in the state—150 in Jammu, 415 in Kashmir and 665 in Ladakh. Dal Lake, Anchar Lake, Manasbal Lake and Wular Lake are some of the larger wetlands in the region which are today threatened by urbanisation. Srinagar's natural drainage system has collapsed making it prone to urban floods.

Half of water bodies lost

In 2014, continuous rain for two to three days flooded Srinagar with water from the Jhelum. This would not have happened a few decades ago, say Humayun Rashid and Gowhar Naseem of the Directorate of Ecology, Environment and Remote Sensing, who have studied the loss of lakes and wetlands in Srinagar and its effect on the city.

They explain that deforestation in the Jhelum basin has led to excessive siltation in most of the lakes and water bodies of Srinagar. They compare two maps of the city—one of 1911 and another of 2004 (see 'Srinagar's lost saviours'). Their analysis shows that wetlands like Batamaloo Nambal, Rekh-i-Gandakshah, Rakh-i-Arat and Rakh-i-Khan and the streams of the Doodh Ganga and Mar Nalla have been completely lost to urbanisation, while other lakes and wetlands have experienced considerable shrinkage in the past century.

The study involved mapping of nearly 69,677 hectares (ha) in and around Srinagar. The analysis of the changes that have taken place in the spatial extent of lakes and wetlands from 1911-2004 reveals that the city has lost more than 50 per cent of its water bodies.

When some low-lying areas in Srinagar go under water during heavy rains, people blame the drainage system. What they don't realise is that they have constructed their houses in those low-lying areas that were previously used as drainage basins for the disposal of storm water, says Mehrajudin Bhat, executive engineer of the J&K Urban Environment Engineering Department. "People in the city have connected their sewage lines directly to drains that are meant for the disposal of storm water. This leads to choking of drains," he explains.

Bhat's prognosis is not wrong. In 1971, Srinagar's municipal limits covered only 83 square kilometres (sq km). At present, urban agglomeration of Srinagar covers more than 230 sq km. What remains to be seen is whether the 2014 floods will be enough to push the state government to act. ■



PRADIP SAHA / CSE

Going dry

The Dal lake is shrinking. Its waters are weed-ridden. People continue to "build" land on the lake area.

For the people of Kashmir, the unbelievable is happening. Their famed Dal Lake is dying before their eyes. The government says it is "committed" to save the lake, but ifs and buts rule the roost. The water quality of the lake today has deteriorated so much that it prompted the Jammu and Kashmir High Court in 2015 to appoint a two-person court commission to inspect Dal Lake on daily basis and submit weekly reports on its encroachment. The court also asked the Pollution Control Board to monitor the water quality at the outlet of the Sewage Treatment Plants (STPs) every two weeks and the Planning Department to earmark a certain portion of tourism development fund for conservation of this urban wetland. But the Lakes and Waterways Development Authority (LWDA) officials maintain that situation is under control because of the three STPs on the periphery of the lake to treat the sewage entering into the lake. However, after the 2014 floods, the sewerage control mechanism for hotels around Dal Lake is not working at full capacity.

Money down the drain

The current state of the lake is a result of decades of government apathy and people's commercial interest in the water body. This is the reason millions of rupees have already been spent on the lake, but nothing much has changed. In fact, experts fear that the damage is so bad that the lake might never regain its former glory.

The devastating flood in 2014 could have been averted had the government taken necessary steps to save the drainage channels of Srinagar

"Scientists say that the Dal Lake will be no more in 30 years, but I feel that it will die within 20 years."

— MOLVI IFTIKHAR HUSSAIN ANSARI

Over ₹300 crore has been spent on the lake under the National Lake Conservation Plan of the Union Ministry of Environment and Forests and Climate Change (MoEF&CC). In fact, one the first major attempt to save the lake happened in 1997 with the launch of the ₹500 crore Save Dal Project. The project was started after the state government sought help from MoEF&CC to restore the lake to its former glory. This was during Saifuddin Soz's tenure (1997-99) as environment minister. Subsequently, Dal was accorded top priority under the National Lake Conservation Plan, which includes 21 lake systems across the country.

A Project Feasibility Report (PFR) was prepared by the MoEF in consultation with the state ministry of housing and urban development and LWDA was set up to implement the project. According to the agreement, the Centre "agreed in principle" to shoulder the conservation expenditure amounting to ₹297.90 crore, while the state decided to bear the rehabilitation expense of Dal dwellers estimated at ₹194 crore. But, in 1999, the ambitious project had hardly made any headway. While Soz blamed it on both the Central and state governments, Jammu and Kashmir Minister for Housing and Urban Development Molvi Iftikhar Hussain Ansari said, "Despite shortage of finances, we have released money. But the Centre has not kept its commitment." Meanwhile, scientists started predicting the death of the Dal. Even Ansari, who is also the chairperson of LWDA, said, "Scientists say that the Dal Lake will be no more in 30 years, but I feel that it will die within 20 years."

The genesis of the problem

The most serious threat to the lake comes from the swelling population within and on its periphery. The lake shelters 58 hamlets with a population of 50,000, who have property rights over 300 hectares of agricultural land and 670 ha of water area as per the socio-economic survey of 1986 conducted by the Urban Environment Engineering Department (UEED). All this has drastically reduced the size of the lake. According to ancient manuscripts, the lake area was 75 square kilometres in 1200 AD. This had been reduced to 10.56 sq km in 1983, says R D Kundanagar, director, research and development, LWDA.

The government banned construction of huts and other structures on the lake and the periphery as early as 1978-79. But encroachments on the lake continued unabated. "This became possible only by greasing the palms of the officials concerned," sources in LWDA say. Besides, there are more than 1,400 houseboats on the lake, a LWDA report says.

Then there is the problem of siltation. According to PFR, the Dal receives 80,000 tonnes of flow annually. The heavy inflow of silt, sediments and nutrients from the catchment and peripheral areas of the lake have also resulted in reduction of the inflow of water and prolific growth of weeds. The red algae bloom in the lake—first noticed in 1993—is just one example, say LWDA officials. The pollution is also taking a heavy toll on flora and fauna in Dal wetlands. Microorganisms have vanished altogether and the population of some indigenous fishes have also been reduced considerably. ■

DELHI-NCR



Total number of wetlands

573

(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)

363

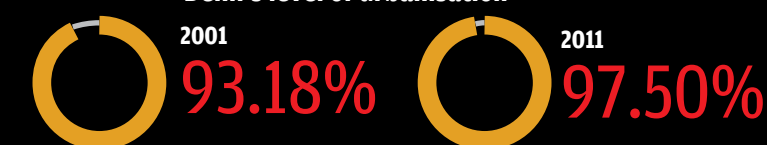
Most urbanised city

Delhi

Urban floods (in past decade)

Delhi
3

Delhi's level of urbanisation



High on construction

Being one of the most urbanised cities in the country, Delhi is at a high-risk of urban floods. The rate of urbanisation can be gauged from the fact that the built-up area increased by seven times between 1970s and 1990s. During this period, the area under wetlands in the city reduced to one-third of its earlier size. The last

major flood the city witnessed was in 2013, when the water level of Yamuna rose to 207.49 metres, the highest water level ever recorded in the river. Various low-lying areas in east Delhi were inundated by Yamuna waters in 2013.

ATTEMPTS TO SAVE WETLANDS

2010

A case was filed by non-profit Tapas in the Delhi High Court to protect the city's degrading wetlands. A year later, the court asks the Delhi government to survey the number of water bodies in Delhi and to undertake restoration projects. A final verdict on the case is awaited and encroachment continues unabated.

2013

The Delhi High Court directs the police to ensure that water bodies such as lakes and ponds are not encroached or allotted in future for development work.

2015

The National Green Tribunal asks various government authorities to file a report on the status of water bodies under their jurisdiction. Reports from most authorities are pending.

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Aravallis undermined

The Supreme Court ban on mining alone won't save Haryana's natural lakes

The Supreme Court on May 8, 2009, banned mining activities in Faridabad, Gurgaon and Mewat districts of Haryana, but mining continued. As a result, in 2014, the apex court asked for a ban on illegal mining. The ban was to be in force till the state came out with a report on how it will restore the ecology of the 450 sq km area, including the lakes around the Aravalli hills, laid waste by mining. The report is yet to be submitted. The court passed the 2009 order on a 1995 petition that was later merged with the omnibus forest case the court has been hearing since 1996 (T N Godavarman Thirumulpad v Union of India and others).

The apex court till the 2009 verdict had been stressing on balancing mining with ecological concerns but satellite images showing dried lakes convinced the judges an immediate ban was needed. The state government and the mining lobby had been using the leeway given by previous court orders to carry on mining. "The court first decided to deal with the mining issue due to public outcry against the lakes drying up. Other issues like encroachment will be taken up later," said Ravi Kant, legal adviser to the Faridabad-based non-profit, Shakti Vahini, that has been lobbying against mining in the area.

With no water left, the structure for measuring water level at Badkhal Lake is of no use



GEETIKA JAIN / CSE

Actions and words vary

On February 27, 2009, the then Haryana Chief Minister Bhupinder Singh Hooda had said that Badkhal and Surajkund lakes in Faridabad and Dumdama Lake in Gurgaon would be revived before the 2010 Commonwealth Games. But his government's department of geology and mines went ahead with auctioning of mines in Sirohi and Khori Jamalpur villages in Faridabad on March 3, 2009, without bothering about environmental consequences. It was another matter that no one came forward with a bid because of the ongoing court case.

The Supreme Court in 1996 had directed mining leases could not be renewed within two- to five-kilometre radius of Badkhal without permission from the central and state pollution control boards. Mining in other areas continued unabated. Hooda justified mining by saying that the lakes had not dried up because of mining alone. The mining lobby said the same in court: the groundwater depleted because the Delhi government sunk tubewells near the border. The then Haryana tourism minister Kiran Chaudhary disowned any responsibility for the lakes. She said she was responsible only for the commercial complexes in the lake resort. "The irrigation department is responsible for filling the lake," she said.

Toxic revival plan

The only state-level plan so far to revive the Badkhal Lake, prepared by the Haryana Urban Development Authority (HUDA), proposed filling the dry bed with slurry from the thermal power plant near National Institute of Technology, Faridabad. Officials said the fly ash would settle at the bottom of the lake and then the clear water above could be used for watersports. But water contaminated with fly ash will have heavy amounts of toxic nitrates and heavy metals, pointed out S P Datta, director of Nuclear Research Laboratory, Indian Agricultural Research Institute, Delhi. "A system for removing the fly ash will have to be incorporated in such a plan and that will be very costly," he said.

As for the Surajkund Lake, Chaudhary said she had given the relevant file to the culture ministry, overseeing the lake's rejuvenation plan. The Archaeological Survey of India (ASI) that has to implement the plan said it could revive the lake only if the state does something about restoring the catchment area. No department is willing to take responsibility to restore the lakes; no one knows who will. In 2011, the Central Groundwater Board submitted a report on revival of Surajkund and Badkhal lakes. ■

Failed promise

Delhi government is silent on a unified authority for managing water bodies it had announced in 2011

In 2011, the Delhi government announced it will set up a Waterbodies Authority for proper restoration and maintenance of lakes and wetlands in the city. Five years later, the umbrella body is yet to be set up.

Currently, lakes and wetlands in Delhi are under different land owning agencies namely the Delhi Development Authority, Delhi Jal Board, Municipal Corporation of Delhi and the Public Works Department. This makes their monitoring of water bodies is difficult. The authority was proposed to be formed on the lines of the Lake Development Authority in Bengaluru, which is an autonomous regulatory, planning and policy body for protection, conservation, regeneration and integrated development of lakes.

The authority, which was to be set up under the Department of Environment, would involve experts from the fields of water, civil engineering, horticulture and forestry. The department's Parks and Garden Society would implement the revival and restoration works through public private partnerships.

The proposal was the outcome of a public interest petition filed in the Delhi High Court in 2000 by Tapas, a non-profit, for saving water bodies in the city that are important for groundwater recharge but are under constant threat from encroachment and pollution. In 2006, the high court formed a three-member committee to find out the exact number of water bodies in Delhi. The committee carried out a survey for five years and concluded there were about 900 water bodies across the city. "We arrived at the figure considering that there will be at least one pond in each village," says Arvind Sah, a member of the committee and advocate of Tapas. "However, 400 or less wetlands exist currently and almost all of them are dry or polluted. Most remain polluted by raw or partially treated sewage, he adds. ■

Over half the 900 wetlands in Delhi have been encroached upon



SALAHUDDIN SAIPHY / CSE

RAJASTHAN



Total number of wetlands

46,748

(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)

10,796

City with most water bodies
Udaipur

Urban floods (in past decade)

Jaipur

3

Udaipur

2

State's level of urbanisation

2001

23.39%

2011

24.89%

Left to die

Almost all water bodies of Udaipur, popularly called the city of lakes, are highly polluted and encroached upon. The condition of Pichola Lake is symptomatic of the ills that plague the lakes and rivers of the city. Once an important source of drinking water, the lake today is surrounded by 55 raw sewage inlet points that carry untreated effluents from over 3,500 industries. The city's lakes are also choking due to

siltation. Rains cause run-offs in the upland slopes carrying huge silt discharge, which ultimately settles in the city's lakes. Embankments have been constructed all along these water bodies to help contain more water, but they have had an opposite effect: seepages and cracks in these embankments, when the lakes overflow during monsoons, have resulted in a colossal loss of water.

ATTEMPTS TO SAVE WETLANDS

1992

Balwant Singh Mehta (1992) and Praveen Khandelwal, along with Jheel Sanrakshan Samiti (1997), file public interest petitions in Rajasthan High Court on Fateh Sagar and Swaroop Sagar lakes in Udaipur.

2007

The high court asks Rajasthan government to form a lake development authority and to effectively protect the no-construction zone. It says no conversion and construction in/around lakes and their catchment, except on "rare occasions".

2012

The high court criticises the state government over illegal allotments and encroachments in the catchment area of water bodies in the state. It says that government officials were encouraging illegality.

2015

The high court bans all activities, including bathing and washing of clothes, in lakes in Udaipur to curtail pollution. But degradation of water bodies and their catchments continues.

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Sunset over Udaisagar

The lake in Udaipur is under immense pressure and could die in the near future

Udaipur, the historic capital of Rajasthan's storied Mewar region, is known as the Venice of the East for its lakes. Maharana Udai Singh II founded Udaipur in 1559 and built a chain of lakes to make the rainfall-deficient city self-sustainable in water supply.

While Fatehsagar and Pichola are the more visited landmarks, just outside the city's municipal boundary lies Udaisagar, which is in grave danger of dying. Being the last in the chain of lakes, Udaisagar is fed by the overflow from upper lakes such as Pichola and Fatehsagar (see "Threatened catchments"). Several seasonal streams also flow down the catchment hills, spanning 479 sq km, to replenish Udaisagar. But over the past three decades, the catchments of Udaisagar and other lakes have degraded. Tej Razdan, convenor of Jheel Sanrakshan Samiti (JSS), an Udaipur-based non-profit, says that according to data available with his organisation, of the total catchment area, 10-15 per cent has been encroached upon in the past decade. In the same period, 15 per cent of forest cover has been lost. Moreover, he adds, the water bodies atop the Aravalli hills that feed these lakes have been choked with marble slurry deposited after

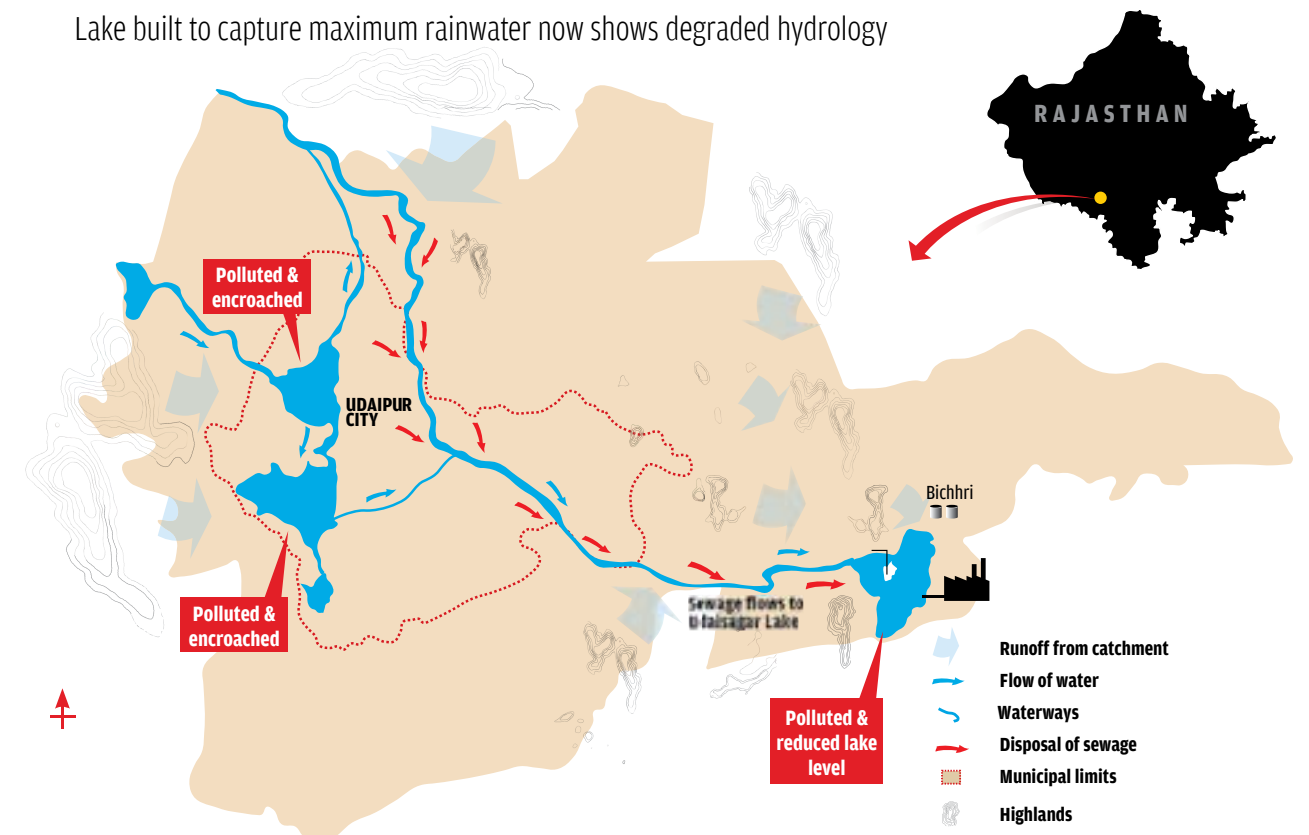
Vardhan Enterprises is building a hotel on the island in the middle of Udaisagar Lake



COURTESY: JHEEL SANRAKSHAN SAMITI

Threatened catchments

Lake built to capture maximum rainwater now shows degraded hydrology



marble mining. A number of national and state highways also pass over the catchment hills. All this is affecting the water flow from upper lakes, reducing the water level of Udaisagar, says Lakshmi Lal Sharma, retired lake expert from the Maharana Pratap University of Agriculture and Technology in Udaipur. Reduced rainfall in recent years has compounded the situation, Sharma adds.

The lake is also being threatened by increasing pollution, says Pradeep Kumar Singh, professor at the university. The Ahar, a tributary of the river Berach, is the lake's major source of water. But more than water, the Ahar brings domestic and industrial waste into the lake as it passes through Udaipur city. Hindustan Zinc Limited located in the vicinity of Udaisagar, extracts the lake water and releases untreated effluents into it. The biological oxygen demand (BOD), a parameter used by scientists to understand the pollution level of the lake, reaches as high as 65 mg per litre which is almost 20 times the permissible limit. The reduced amount of water in the lake has taken away its self-cleansing power, says Sharma, adding that the lake is majorly eutrophicated. The polluted water is highly acidic and affects the groundwater of the neighbouring villages in a diameter of 21 km. For instance, the water in the wells of Bichari village is not potable and can't even be used for irrigation.

But revival of the lake seems distant. There is an island in the middle of Udaisagar where rampant construction is happening and even the Supreme Court has given the go-ahead.

An ugly concrete structure

Till a few years ago, farmers lived on the island and farmed on it. In 2008, Vardhan Enterprises, a Mumbai-based developer purchased most of its land and started to construct a five-star hotel on it. In 2010, Rajendra Razdan, lawyer for JSS, moved the Rajasthan High Court against the construction. Since 1999, Razdan has filed several petitions in the high court to save Udaipur's lakes. In 2012, the court fined the developer ₹1 crore and asked city authorities to demolish the illegal construction. The developers moved the Supreme Court in 2014.

The developers were desperate. They told the apex court that the construction site was not a "true island". It was "an island-like area" formed by siltation, explains Razdan. "They justified that they had in no way fiddled with the ecology of the lake. The Supreme Court has agreed. The developers have restarted construction and we can see many structures on the island," he says. The project had to be stopped after local residents started protesting. But most fear, this would not be enough, especially after the Supreme Court nod.

According to environmental lawyer Sanjay Upadhyay, the toothless Wetland Rules 2010 is responsible for such a fate of the country's lakes and wetlands. Under the Rules, a wetland and its drainage or catchment area need to be notified by the Centre. Since water is a state subject, the first step of this notification starts with the state government identifying them. Upadhyay says this is where the law is missing its efficacy. If the state fails to identify the wetland or its catchment then the wetland might be easily killed. This is exactly what has happened in the case of Udaisagar, says Ram Niwas Mehta, secretary, Urban Improvement Trust (UIT), the body responsible for the overall development of Udaipur. ■

New lease of life

Mansagar Lake revived under a public-private partnership scheme

Each year, the Mansagar Lake in Jaipur would swell and spread during the monsoon. In the lean season, the lake water would recede from the margins. The reclaimed land would be brought under cultivation, mostly to grow vegetables, while children would find dry patches to play cricket. But for the past four years, children living in encroached areas south of the lakefront have been unable to find a dry patch to pitch their wickets. Reason: the lake has turned into a perennial water body.

The lake bed was dredged to enhance its holding capacity. The authorities implemented a scheme to discharge treated sewage in the lake to ensure the water balance was maintained in spite of evaporation losses. This prevented the lake's decline from a maximum spread of 139 hectares (ha) during the monsoon to 49 ha in the pre-monsoon lean period. The transformation took place after the initiation of a project in 2006, under which the lakefront was leased out to a hospitality group and the lake's health was tied to revenues from tourism. The water quality of the lake has also improved over the past five years as the revenues earned were used to prevent pollution.

PPP model that worked

Mansagar, once a natural shallow water body situated in the northern fringe of Jaipur, became a larger point of water collection in the 18th century after a dam was built between Amber hills and Amargarh hills. The water quality in the lake began to deteriorate in the 1960s when city authorities diverted most of the city's sewage into the lake through two drains. As Jaipur grew into a tourist destination in the 1970s, the lake suffered further, turning into a receptacle of the city's filth and sewage. Attempts in the past three decades failed to control pollution and protect the Jal Mahal, a monument within the lake, since maintenance was never taken up as a public spending priority.

The revival of Mansagar was achieved by dredging the lake to a depth of 3-3.5 metres in 2008 to increase its water-holding capacity and diverting treated sewage into it to maintain the water balance



In 2002, the Union Ministry of Environment and Forests & Climate Change (MoEF&CC) appointed the Jaipur Development Authority (JDA) as the nodal agency for Mansagar's restoration under the National Lake Conservation Plan, and sanctioned ₹24.72 crore. It gave JDA ₹17.3 crore and asked the state government to raise the remaining amount. But the funds were insufficient to maintain the sewage treatment facility or any of the other civil works.

The state government then conceived a tourism project to lease out 40 ha of the Mansagar lakefront, providing an opportunity to develop a stipulated five ha built-up area for entertainment and hospitality. A tender was floated in 2004, and four consortia bid for the project. Jal Mahal Private Limited, led by Kothari builders, bagged the contract. The following year, a 99-year lease was signed with the state government, at an agreed ₹2.52 crore annual lease amount, with a built-in 10 per cent increase every three years. The objective behind private sector participation was to ensure funds to operate and maintain the pollution abatement infrastructure.

The revival of Mansagar was achieved by dredging the lake to a depth of 3-3.5 metres in 2008 to increase its water-holding capacity and diverting treated sewage into it to maintain the water balance after taking into account evaporation and percolation.

The water quality improved, too. In July 2005 and 2006, when MoEF&CC tested the water for its quality, its biological oxygen demand (BOD)—an indicator of organic pollution—was in the range of 115 to 210 mg/l, which was several times higher than the bathing quality standard of 3 mg/l. Today, the two *nullahs* carrying untreated sewage have been intercepted and diverted to carry the dry weather flow or partially treated sewage downstream where it is used for irrigation. Only stormwater is allowed to enter the lake now.

But then stormwater drains inevitably carry sewage from unsewered colonies. The developer monitored the first flush after a storm and found it having higher BOD when compared with untreated sewage. The first couple of years there was a plume of black entering the lake when the rains arrived, since the first flush would carry all the settled muck in the drains, including solid waste. After consultations with experts and the government, the developer decided to take five per cent of the lake area and covert it into an in-situ settling basin, where solid waste would be collected, and a sedimentation tank to reduce the suspended solids and pollution load. The overflow from the sedimentation tank would enter the lake. The water quality improved visibly and has been recorded with a BOD of less than 30 mg/l, the stipulated discharge norm set by the Central Pollution Control Board.

Harald Kraft, international consultant who designed the in-situ natural treatment system, says: "I use this project as a special example of private public partnership, and as an example of what can happen, if the people are dedicated." ■

In July 2005 and 2006, when environment ministry tested the water for its quality, its biological oxygen demand was several times higher than the bathing quality standard

Lake in transition

Is the Pushkar conservation project off the mark?

In 2009, Rajasthan government kicked off a conservation project for the dying Pushkar Lake in Ajmer. But instead of reviving the lake, the project that involved dredging left the lake dry. The ₹48-crore project funded by the Centre and the Rajasthan government aimed to spruce up the catchment and concretise existing channels that carry the run-off. The latter is to curb losses through evaporation and seepage when water flows from the catchment to the lake through feeder channels after rains. The four-metre-deep dredging was done to accommodate the water that might flow into the lake.

But what happened to the four feet of water (1.2 m) that was in the lake before the project began in January 2009. During dredging, said R K Nahar, a geologist formerly with the state groundwater department, a layer of pure clay was dug out, which resulted in seepage. But V K Sharma, executive engineer with the Urban Improvement Trust, the implementing agency for the project, said the loss was natural and not because of negligence.

The agency hired consultants for a soil survey, which gave a clean chit to the dredging operation. Except for 4 per cent of the lake area where there was likely seepage, six-metre-deep clay was in the lake after dredging, the survey report said. It recommended laying a natural clay layer of 300 mm in the area. An

The conservation attempts of Pushkar Lake have worsened its health



MEETA AHALAWAT / CSE

official of the trust, though, admitted that percolation increased after the clay layer was disturbed. So, they decided on laying 0.3-0.7 m clay in 40 per cent of the lake bed.

Offering another explanation, O P Hingar, team leader of WAPCOS, consultants for the lake conservation project, said the four-feet of water in the lake was maintained through tubewells. “People did not know water from the tubewells was discontinued for dredging. So they were surprised when the lake dried,” he added. But Pushkar is a groundwater-fed lake, argued Nahar, and “the authorities must recharge groundwater, not concretise feeder channels”.

Misplaced priorities?

Earlier, rains would recharge groundwater and even in the dry season several springs would flow towards the lake. These natural sources are all dry now. The withdrawal of groundwater is three times more than its recharge, according to a study by the state’s groundwater department.

Attempts to curb withdrawal of groundwater have not yielded results: in 2003, the Central Groundwater Board banned withdrawal of water in 14 villages near Pushkar.

Drilling machines around Pushkar are common, said Nahar. “The lake has shrunk to a third of its size. What used to be two-thirds of the submergence area is now encroached by hotels and cultivable land,” he added. Amal Kar of the Central Arid Zone Research Institute in Jodhpur supported the concretisation drive. “We cannot stop withdrawal of groundwater.”

Maximising surface run-off reaching the lake in that case is a good effort,” he said. Besides, said Hingar, the surface run-off is limited due to sandy soil. The inlet channels are not well-graded paths and the feeders have depressions, which lead to higher evaporation and seepage losses; “94 per cent of rainfall in the lake catchment is lost enroute,” said Hingar.

How much water

The 21.87-sq km lake catchment records an average rainfall of 400 mm annually. Assuming 400 mm rainfall is accounted for, 21.87 sq km will generate 8.748 million cubic metres of water. The deepening of the lake by four metres has increased its capacity from 0.79 to 1.196 million cubic metres, which is 13 per cent of the total generation capacity. The lake will spill over if more than 13 per cent of all rainfall in the catchment finds its way to the lake. “After improvements to the catchment, we intend to tap more than this,” said Hingar, “to ensure we have carryover water for the next year.”

Concretising channels is foolish, because the streams also recharge groundwater, said Tej Razdan, general secretary of the non-profit Lake Protection Society in Jodhpur. “In their attempt to top up a deepened lake they have destroyed the ecology of the area,” he added.

Rajasthan government is now planning a masterplan for Ajmer, which will include conservation plans for Pushkar Lake and its feeder channels. ■

GUJARAT



Total number of wetlands

23,891

(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)

8,858

Most urbanised city
Ahmedabad

Urban floods (in past decade)
Ahmedabad **7** Surat **4** Vadodara **4**

State’s level of urbanisation

2001 **37.36%**

2011 **42.58%**

Not so rich after all

While Gujarat is one of the most prosperous states in the country, its performance with conserving wetlands has been poor. According to Central Groundwater Board, there has been a decline of three metres per year in the groundwater level of Ahmedabad in recent times. In 1960, Ahmedabad had 204 lakes. Today, only 137 water bodies remain. Out of these, at least 65 have witnessed construction

of apartments and other structures approved by the government under various town-planning schemes. In July 2000, when it rained 508 mm in one day, the city as well as the outskirts went under water. As soon as the monsoon was over, the city faced a huge water crisis, which was so severe that it became a political issue. Still the legislators never thought of conserving the lakes.

ATTEMPTS TO SAVE WETLANDS

2000 and 2003

Ahmedabad resident Shailesh R Shah files a public interest petition in the Gujarat High Court requesting the court to revive and recharge the Chandola Lake situated on the outskirts of Ahmedabad. In 2003, the high court delivers the final judgment that directs authorities to protect and recharge them. However, the restriction on building activity around lakes, which had brought builders to their knees, is later lifted. Solid waste dumping and encroachment continues in the lake.

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2015

In a public interest petition filed by Aam Aadmi Party member Ritu Raj Mehta in July 2015, the Gujarat High Court directs the civic body to prevent encroachment upon water bodies in Thatlej area by constructing fences around them. It also orders the Ahmedabad district collector to take action against encroachment and dumping of waste in Thatlej area, which lies on the city’s eastern side. Nothing significant has yet been done to conserve the water bodies.

Real estate on water

How real estate and politicians teamed up to generate public pressure on Gujarat High Court to allow concretisation of Ahmedabad lakes

In early 2001, new construction activity in Ahmedabad virtually came to a standstill. All because the Gujarat High Court, acting in response to a public interest petition filed in October 2000 to protect lakes and increase water availability in the city, restricted new constructions in a radius of 500-1,000 metres around 137 pieces of land that the additional resident deputy collector had listed as lakes in his affidavit dated November 20, 2000. It also directed authorities to ensure “lakes are used as lakes”. At least 65 of these ‘lakes’ existed only on paper—houses, schools and stadiums had been built on them with official sanction. The Ahmedabad Municipal Corporation (AMC) and the Ahmedabad Urban Development Authority (AUDA) were lost. Builders and even the Indian Institute of Management (which had land adjoining a water body) filed affidavits, asking the court to modify its order. The case came to light because of Shailesh Shah, a trader who lived in Mani Nagar in southeast Ahmedabad, which neighbours Chandola, the biggest lake of the city. In his childhood, he had seen crocodiles in the lake. The lake was reduced to a dry dustbowl, with encroachments dotting its periphery. Water shortage in the area was severe. He took the matter to court.

Real estate real politik

In 1960, the city of Ahmedabad had at least 204 lakes. But by early 2000, almost all had been built upon, encroached, or left to disuse. The high court order covered 137 lakes. And at least 65 of them had constructions like housing

A dried up Chandola Lake



SANTUKTA DASGUPTA

NOT MUCH HAS CHANGED SINCE

The two-year-long legal battle initiated by Ahmedabad resident Shailesh Shah concluded in August 2003, when the Gujarat High Court gave the final verdict. The court ordered the state government, urban development authorities and the municipal corporation to preserve the lakes and ponds in the state. It asked to check any sort of pollution and encroachment.

The court order said that the responsibility of deciding the distance from the lake to the construction site is left to the discretion of the civic authorities, based on town planning regulations. Earlier, in May 2002, Ahmedabad Urban Development Authority (AUDA) had notified the General Development Control Regulations, permitting construction within nine metres of water bodies.

Following the court order, the Gujarat government created a water resources council, headed by the chief minister to oversee the programme for rejuvenating all water bodies. It was decided that a water resources committee chaired by the chief secretary of the state would assist this committee. These measures proved to be of little use.

After the high court ruling, the municipal corporation tried to stop industrial effluents from flowing into the lake, but solid waste dumping and encroachments were not taken care of, says Shah. He explains that the Kharicut canal, which was a major source of water to Chandola reservoir, is totally choked with garbage due to negligence of the civic authorities. The other small canals have also been filled or diverted on the pretext of development works. The lake bed is gradually turning into a garbage dump, says Shah. Repeated pleas to clear the encroachments and rehabilitate them have fallen on deaf ears. In 2009, Ahmedabad Municipal Corporation (AMC) officers razed a few illegal constructions near the lake but abandoned the exercise, says Shah.

When contacted, officials of AMC, which is responsible for looking after the Chandola Lake, declined to comment on the state of the water body. When asked about encroachment, they blamed other departments for it.

Meanwhile, the Central Ground Water Board data on groundwater shows that the water level in Ahmedabad has dipped to 95 metres in certain places. With the speedy pace of industrialisation in the state, water management and groundwater recharge has become a challenge for the Gujarat authorities. Many districts have over-exploited the existing groundwater resources. A study by the Columbia Water Center of Earth Institute at Columbia University also highlighted the alarming decline in the groundwater table over the past two decades in Gujarat. This steady decline in the aquifer level has affected the farmers the most as they sink bore wells deeper for water. The civic authorities, however, have turned a blind eye to the problem.

apartments or a stadium, all approved by authorities under various town-planning schemes. With rapid urbanisation, village after village got assimilated into the city, an all-too-familiar story. The town planning schemes didn't take into account the natural drainage patterns and the topography of the area. This led to two things. Rainwater that earlier flowed into lakes and other low-lying areas now got impounded near new residential areas, causing seasonal flooding and water logging. Also, rainwater stopped reaching lakes, making them prime real estate for encroachers or builders; else, they became garbage dumps. The new urban centres relied on piped supply of water or tubewells. The water table kept falling because paved areas prevented percolation of rainwater. In July 2000, when it rained 508 mm in 24 hours, there was widespread flooding in the city's suburbs. And then water scarcity returned as soon as the monsoon got over—so much so that it became a political issue in the September 2000 elections to the AMC. The Bharatiya Janata Party lost control of the AMC for the first time in 13 years to the Congress. Still, the legislators did not make the connection. In September 2000, after the court had ordered AMC and AUDA to crack down on illegal constructions, the state urban development minister went on record to say the buildings should not be demolished. Two months



PREETI SINGH / CSE

Sandeep Brahmabhat, the main petitioner of the Gopalnagar case, watches a flock of lesser flamingos at the Borisna tank

later, the court ordered disconnection of electricity to 150 buildings for non-compliance with fire prevention and safety norms. The issue became a law and order crisis, with widespread protests and violence against the order. The case revealed three clear ways to appropriate lakes:

- Lakes usually belong to the revenue department, and revenue land is the easiest to encroach. Once squatters take over, they obtain political patronage in return for votes.
- The land use is legally altered in the government records to make room for other public utilities, such as a stadium or a park or a school. Land use includes building houses for poor people. But once construction begins, the builders can step in and create “stock”, selling it at market rates.
- It used to be a common practice in villages to grant rights to people to harvest produce from lakes, for example, water chestnut. Often, over time, such lands got registered in their name. Builders purchase these lands and develop property, but this requires the collusion of the village sarpanch, the circle inspector, or officials of the revenue or urban development departments. In September 2002, the high court delivered the final judgment in the Ahmedabad lakes case. It directed authorities, which had actively contributed to the destruction of the city’s water bodies, to protect and recharge them. However, the restriction on building activity around lakes, which had brought builders to their knees, was lifted: “The question of determining the peripheral area surrounding a lake or pond on which construction may be prohibited will be taken up by the concerned authorities...”. Earlier, in May 2002, the city development authority had notified the General Development Control Regulations, permitting construction up to 9 metres from the water bodies. The court direction allowed precisely that. A victory for land, not for water. ■

Left to dry

Ahmedabad Municipal Corporation hopes to arrest the city’s dipping groundwater by reviving its dying lakes. But in the absence of strong wetland rules and intention, the efforts will prove futile

The water table of Ahmedabad, like in most cities in the country, is dipping at an alarming rate, with the levels in many regions plummeting to more than 100 metres below ground level. The reasons are the same—unfettered urbanisation and industrialisation—and so is the city’s proposed solution—revive the groundwater levels by restoring its lost lakes.

The solution may sound simple but executing it on the ground is a daunting task. An optimistic Ahmedabad Municipal Corporation (AMC) says it is identifying the lakes under threat and will then draw a plan to revive them.

Going dry

Associate professor at Gujarat University, Hitesh Solanki, who has documented the status of several lakes in the city, says development around the lakes led to encroachment of the natural waterways, resulting in their death. One example is the Sarkhej Roza Lake, which is located 8 km southwest of the main city. This peri-urban area was turned into an industrial hub in 1998 and brought under the jurisdiction of the city’s municipal corporation. The lake, built by Sultan Mehmud Begda in the 15th century, has monuments of archaeological importance, which are a popular tourist attraction.

Encroachment of feeder channels and illegal excavation of lake bed are responsible for the decay of the Sarkhej Roza Lake

“Before 2004, migratory birds, including cormorants and flamingos, were often seen there between December and February,” says Bhavana Ramrakhiani, convenor, Ahmedabad Community Foundation (ACF), a non-profit working on environmental issues. She adds that the construction of high-rise buildings



SUSHMITA SENGUPTA / CSE

on the Sarkhej-Gandhinagar highway in 2004-05 led to the loss of greenery in the area. The human-made lake was part of a network of lakes in the area. “It traditionally received water from the elevated Shingoda or Makarba *talaav* (lakes), which received water from lakes (in Prantij and Santej villages) near Ahmedabad,” says Vasudevan Nair, deputy general manager of AMC, who looks after the heritage department of the civic body.

The problem began when the inflow of water from the feeder Shingoda *talaav* stopped because of encroachment of the feeding drains connecting the two lakes. Today the Sarkhej Roza Lake has water for just three months during rains. “The high rate of evaporation in the area does not allow the water to stay for more than three months and this period is too short to allow groundwater recharge in the area,” says Nair. “Till 2005, tourists would enjoy boat rides on the lake throughout the year,” says Shafi Ahmad, who sells beads and metal rings in the area.

Abdul Gani, a frequent visitor to a *dargah* in the area, says that groundwater was always shallow in the area, but in the past seven to eight years it has dipped to 15 metres. “I used to take bath in the lake during summers, but it is now dry most of the year.”

Uphill task

Talking about how difficult a task it will be to revive the lake channel, Ramrakhiani says Makarba *talaav* is not even notified as a lake in government records. The other major issue is that the land mafia around the area digs away the soil from the lake bed for the construction of buildings. The municipality claims it has lodged complaints several times against these builders to stop the excavation but there has been no positive outcome.

Nair explains that the high rate of excavation from the lake has lowered the level of Makarba *talaav* much below the level of Sarkhej Roza and this has stopped the natural flow into the lake. Non-profit ACF says illegal soil excavation from the lake started in 1998-99. The Archaeological Survey of India (ASI) was renovating the monuments around the lake during this time, but they did not stop the illegal excavation because they are “only supposed to take care of the monument and not the water body adjacent to it”, says an ASI official.

“Encroachment of the drains between the two lakes, lowering of the bed of Makarba *talaav* meant rainwater stopped flowing between them,” says Nair. “In 2009, with the help of Ahmedabad Urban Development Authority (AUDA), there was an attempt to fill up the Sarkhej Lake,” says Arif Agharia, senior conservation assistant, ASI. Agharia said that ASI protested against this plan of bringing water into the lake by artificial hume pipes.

In November 2012, AMC started laying stormwater drains in Sarkhej village and connected the drains to the Makarba Lake. This brought some life to the Sarkhej Lake in the monsoon of 2013. Ramrakhiani says “this temporary solution” is effective during the monsoons only. Solanki adds that analysis of the water collected in the Sarkhej Lake after the monsoons showed high concentration of phosphate in the water which indicates that domestic sewage was entering the lake through the stormwater drain.

2005



In just seven years, the Sarkhej Roza Lake has transformed from a lake to a dry patch of land

2012



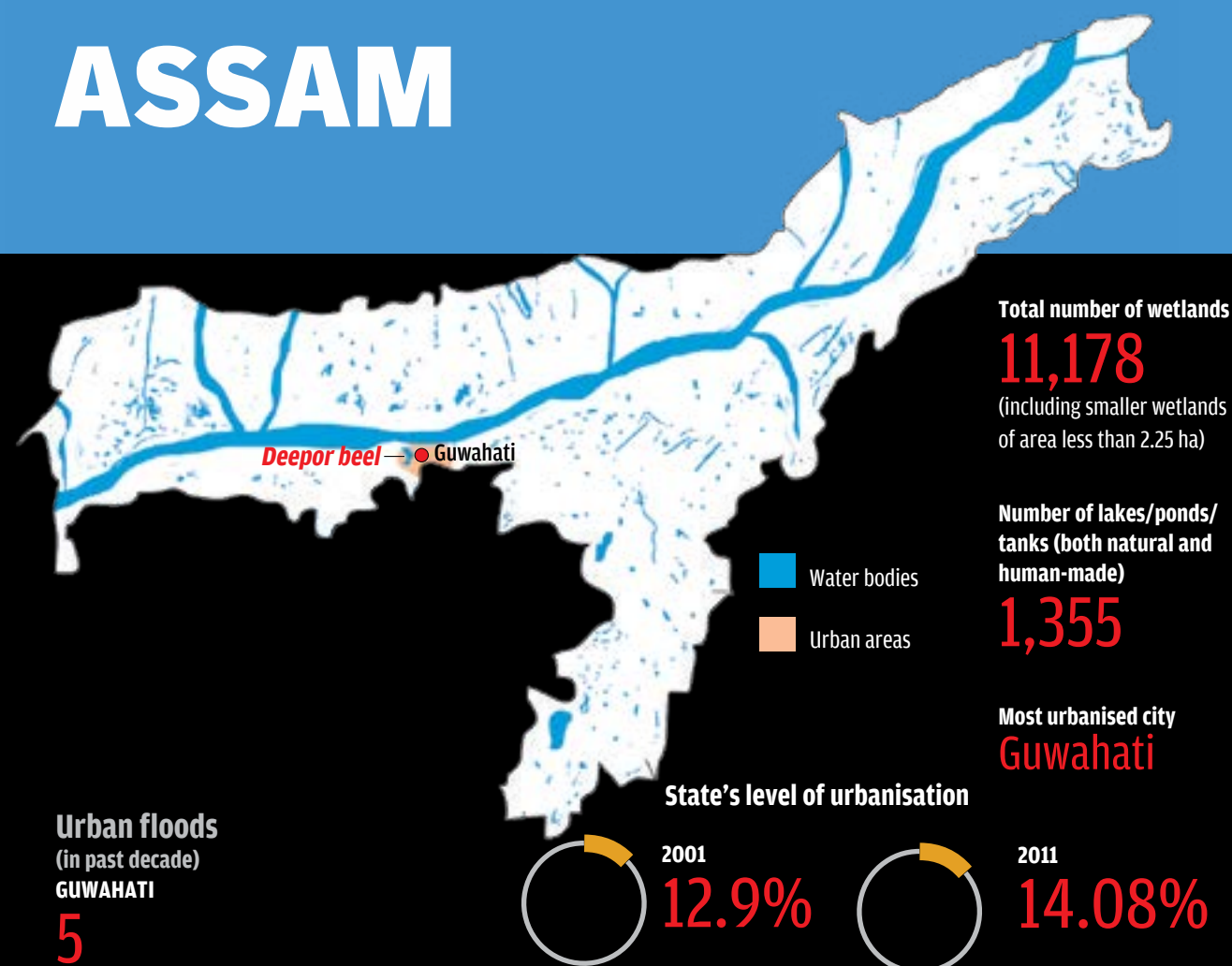
AHMEDABAD COMMUNITY FOUNDATION

The same story holds true for almost all the other lakes in the city, including the Chandola Lake (see ‘Real estate on water’), the largest lake in the city. In 2000, Ahmedabad lawyer Shailesh Shah filed a public interest petition to save the water bodies of Ahmedabad. In response, the court ordered the authorities to preserve the lakes and ponds of the state in 2002. But more than a decade later, the municipal corporation is yet to identify the water bodies that need to be protected.

Experts say the fresh attempt to revive the lakes will fail till the time “effective wetland rules are put in place”. Tej Razdan, convener of Jheel Sanrakshan Society, a non-profit based in Udaipur, says, “The present wetland rules are toothless.” Shashank Shekhar, a hydrologist working in Delhi University, says immediate programmes are needed to revive the water bodies. Nair says that the programmes should not only work on the lakes but also on the feeder channels and catchment areas to make them encroachment-free. This can happen only if the government is committed. ■

Analysis of the water collected in the Sarkhej Lake after the monsoons showed high concentration of phosphate in the water which indicates that domestic sewage was entering the lake through the stormwater drain

ASSAM



Never-ending tragedies

Assam is possibly India's most flood-prone state: since 1950, the state has seen at least 12 major floods. According to Assam Water Department data, 40 per cent of the state is flood-prone. The last major floods in the state happened in September 2015 that impacted the lives of 1.5 million people in 17 districts. The average annual loss due to flood in Assam is ₹200 cr.

And one of the worst affected is the state capital Guwahati, which has witnessed unfettered urbanisation in the recent past. The built-up area in the city has increased by more than 45 per cent between 1997 and 2007. And this has come at the cost of its wetlands, forest and agricultural lands. For example Deepor beel, Guwahati's largest wetland, has decreased by 50 per cent since 1990s.

ATTEMPTS TO SAVE WETLANDS

2000 and 2006

Unnayan Samiti has filed two petitions with the Guwahati High Court in 2000 and 2006 to stop encroachment of Sola beel. Despite the high court asking the state government to protect wetlands, the state revenue department in 2006 allocated lake-bed for construction. The high court gave a stay order on the allotment. In 2013, Unnayan Samiti filed a formal complaint with the police to stop illegal construction in Sola but nothing happened.

2007 and 2014

Two major cases have been filed to save the Deepor beel. The first one was filed by non-profit Unnayan Samiti in 2007 to stop the encroachment and dumping of garbage into the wetland. Despite a Assam High Court stay order, encroachment continues. In another case filed in 2014, the National Green Tribunal (NGT) asked the Assam government to submit a status report on the condition of the wetland in response to a public interest petition filed by RTI activist Rohit Choudhury. The state government is yet to file a concrete reply to NGT.

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Track court cases on www.indiaenvironmentportal.org.in and www.rainwaterharvesting.org

CONTENTS

ASSAM

Watery grave

Encroachment is killing Guwahati's only river and wetlands that can save the city from perennial floods

Every year during the monsoon, Guwahati in Assam witnesses devastating floods. After years of inaction, Chief Minister Tarun Gogoi set up a committee on July 17, 2014, to study the problem and suggest remedial measures.

The state administration has realised that floods are caused by a poor drainage system. Natural and artificial drains in the city get clogged during heavy rains and spill on to the roads. Bharalu, the only river which flows through Guwahati and carries excess rainwater to the Brahmaputra, has been reduced to a dumping ground for garbage by the residents.

Illegal constructions along the Bharalu make matters worse. "The natural drainage has been blocked in many areas as a result of encroachment," the chief minister told mediapersons. It is not just the river. The encroachment of the city's protected wetlands, which took care of the water during floods, is double whammy. Gogoi has promised measures to avert such disasters.

Since the past many years, floods have been throwing life out of gear in the

Bharalu river's ability to carry excess rainwater to the Brahmaputra has reduced because people use it as a dumping ground for garbage



PHOTOGRAPHS: MANASH DAS

CONTENTS

Assam Chief Minister Tarun Gogoi blames floods in Guwahati on the blockage of the natural drainage system



largest city of the state. Houses have been damaged, property has been lost, agriculture and education have suffered. But the consequences this year were unprecedented.

On June 27, 2014, the India Meteorological Department recorded 57 mm rainfall in Guwahati. This was the fifth highest in a decade. Vast areas of the city were inundated. The National Disaster Response Force had to be called in to rescue marooned families in the flood-affected areas. Nine persons lost their lives.

River becomes a drain

Apart from the Bharalu river, there are three rivulets within the city—Mahabharalu, Bahini and Basista. Throughout the Bharalu's course, feeder drains feed waste water into it, reducing the river to a drainage pipeline. According to a study carried out by the Assam Pollution Control Board (APCB) in 2010, Bharalu and Bahini pass through the most populated areas of Guwahati. In the absence of adequate waste disposal mechanism in these areas, people dump solid waste into the water, worsening the pollution. An independent study by Lakhimi Gogoi, an academician associated with the Narangi Anchalik College, Assam, shows that the household waste generation in Guwahati is almost 490 tonnes per day.

Even government bodies, such as the Railways, treat the river as a garbage dumping site. An inspection on February 11, 2014, by APCB officials found that the diesel shed of the Railways in New Guwahati releases untreated toxic effluent into public drains. This merges with the Bharalu, says R M Dubey, APCB chairperson.

"We routinely clean the river. But during monsoon the dug out silt slips back into the water. Another major problem is that as soon as the river is cleaned, it gets filled with plastic and other garbage thrown into the drains which flow into the Bharalu. These get collected in a heap near Bharalumukh pumping station-I. Most of it is non-biodegradable waste generated by business establishments," explains D K Roy, a senior engineer associated with the water resource department which is tasked with cleaning the river. Government officials, however, blame the floods largely on the encroachment of the Bharalu. Over the years, illegal structures have mushroomed on its banks. The wetlands are not safe either. Silsako *beel*, a protected water body, is surrounded by a multiplex, a hotel, a hotel management institute and over 1,000 small houses.

Researchers point out that the intensity of floods as well as the area affected by it in the city have increased. ENVIRON, a Guwahati-based research organisation, conducted a preliminary investigation from 2011 to 2013 in parts of the city—Hatigaon, Panjabari, Ganeshguri, Christian Basti, Bhangagarh, Paltan Bazar, Ambari, Silphukhuri and Chandmari (see 'Inches from disaster'). The group concluded that the water level in these areas during flash floods associated with heavy rainfall rises by 7-15 cm every year. "If this condition persists, after 10 years the average height of the water will go up to 70-150 cm from the present level," says Amarjyoti Kashyp of ENVIRON. He adds that several areas in the city which were earlier untouched by water were flooded this year.

On being asked about this, Prateek Hajela, commissioner and secretary to the Assam government, political department, explained that fearing the possibility of floods, house owners in areas which are usually safe are raising the height of their compounds as precautionary measure. This pushes the rainwater on to the roads and contributes to flood, he adds.

Will eviction help?

Following a directive of the state government to clear the Bharalu river and other water bodies in the city of encroachment, the district administration embarked on an eviction drive along the Bharalu from June 30, 2014. Hajela says that the state has chalked out a three-pronged approach. This includes clearing all illegal constructions around primary drains, simultaneous dredging and action against those who gave permission for construction.

The administration has also cracked the whip on encroachers around Silsako *beel*. "We have dismantled illegal structures at the *beel*. We will continue with our drive to make way for smooth flow of water through Bharalu and other rivulets which carry excess rainwater from the city to the Brahmaputra," says M Angamuthu, in-charge deputy commissioner of Kamrup Metropolitan district. He adds that there are similar plans of eviction for the three rivulets in the city. Tall promises by the administration after floods are, however, an annual ritual. ■

Inches from disaster

Water level during flood in many areas of Guwahati has been rising over the years



Who messed it up?

Guwahati indicts poor settlers for flash floods, ignores damage on wetlands by construction work

The overpowering stench of municipal waste hits one hard on entering Boragaon. Women and children from the nearby squatter's colony squabble over the garbage unloaded by trucks from Guwahati, the sprawling business hub of northeastern India and a million-plus city of Assam. A sole adjutant stork, an endangered bird, meditates on the high rise of waste before being chased away by a dog.

The 24-hectare (ha) municipal dump yard lies on the eastern corner of Deepor beel, a biodiversity-rich wetland near Guwahati. It is also the lone Ramsar site in Assam. Wetlands of global importance are conserved and protected through the international treaty, Ramsar Convention. The dump yard came up in 2005, three years after Deepor was declared a Ramsar site.

Wetlands are the kidneys of nature, says Parimal Bhattacharya, former professor at Guwahati University and member of the Wildlife Trust of India. "They recharge groundwater and serve as stormwater deposits. People depend on them for fishing and agriculture. They also influence a region's micro-climate," he adds. With 9.7 per cent of its area under wetlands, Assam is a

The municipal dump yard on Deepor wetland



PHOTOGRAPHS: SAVANTIAN BERA / CSE

prominent wetland-rich state in the country.

Flanked by the landfill on one side, Deepor beel, as the wetland is called, was notified Ramsar site for 40 sq km area. Now, only 10 sq km is available for water spread. On the southern end of Deepor are stone quarries, adjacent to the Rani-Garbhangra reserve forests, a crucial elephant corridor and habitat of the hoolock gibbon. Intermittent blasts, thick dust from the quarries and constant groaning of trucks make Deepor look more like an industrial hub.

Quarrying within Deepor has pushed this once-pristine ecosystem to the brink of disappearance, says a Planning Commission field report of 2008. It also fixes the blame on construction of a railway line, large-scale encroachment, heavy siltation from the denuded hills, accumulation of filth and waste from the Bharalu and Bahini rivers, unregulated fishing practices and invasion of aquatic weeds.

But Guwahati has grown in the last two decades because of construction work on its wetlands, says Bhattacharya. Its population has jumped from 500,000 in the 1990s to more than 1.2 million now. After the economic boom in the 1990s, wetlands were sold dirt cheap. "The national highway to Dispur, which once had wetlands on either side, now has shopping malls, apartments and showrooms. Residential areas like Tarunnagar and Lachit Nagar are also built on wetlands."

With the disappearance of wetlands, flash floods also increased. So much so that it has become a regular issue during the Assembly elections. The 2010 monsoon had brought telling miseries for the residents of Guwahati. The National Disaster Response Force was called upon to rescue over 200 people and provide relief to many others. In June 2011, the government started evicting "encroachers" from wetlands and hills.

Great wetland grab

"I was born and brought up around Gandhi Basti, located in the south-eastern fringe of the city," says an official with the Assam Science Technology and Environment Council (ASTEC), an autonomous body which advises the state government. "As children, we would fish in the marshy wetlands during rains. But in the past 15 years, most of the wetlands have been filled up. Flash floods have increased manifold as no place is left to absorb the excess water."

The worsening flash flood situation, says the official, was the genesis behind the Guwahati Water-Bodies (Preservation and Conservation) Act, 2008. The Act notified three major wetlands in Guwahati—Deepor, Silsako and Borsolu-Sorusola. But by this time the ground situation had already deteriorated.

Silsako, once a 120-ha wetland, has turned into a grand multiplex. It has a tennis court, a hotel owned by the Tata Group, a hotel management institute, an institute for social studies and land which people say belongs to Devanand Konwar, a former Governor of Bihar who hails from Assam.

On the other side of Silsako are over 1,000 hutments. Most families settled here about 15 years ago. "The collapse of the rural and agricultural economy

Deepor beel was notified Ramsar site for 40 sq km area. Now, only 10 sq km is available for water spread

post-1990s and the boom in construction and service sector around Guwahati fuelled this migration,” says Arupjyoti Saikia, professor at the Humanities department in IIT-Guwahati.

The government calls us encroachers. “We came here looking for jobs and bought the land from tribals,” says Nokman Ali, a construction labourer and an “encroacher” at Silsako. “I have worked to construct the Tata Group’s Ginger Hotel. Why does the government want us to clear the place when it allowed the rich to build on wetlands?”

“This is plain double standards,” says Jinti Gogoi of Krushak Mukti Sangram Samiti (KMSS), a civil society group fighting eviction of marginal families.

Though the government cites wetland encroachment as the reason, there are several other for flash floods, says the ASTEC official. “The networks through which small rivers like Bharalu and Basistha carry water to the Brahmaputra are fragmented,” he says. Pollution and improper sewerage block the flow. The city never had a sewage treatment plan.

The disappearing wetlands and hill slope destabilisation have worsened the situation. Guwahati has several forested hills, but many have been denuded. The red, slushy mud gushes with rainwater flooding the city. The soil of the hill is also used to fill the wetlands and as raw material in the construction industry. “Two-thirds of the city was built by filling lowlands and wetlands with the hill soil,” says Pulin Kolita, who in 2011 worked on the state of Guwahati’s wetlands as a media fellow with the Centre for Science and Environment, a Delhi-based non-profit.

Shrinking wetlands



Deepor beel: Encroached by stone quarries, dump yard. Channels to Brahmaputra are choked
Silsako beel: Has hotels and commercial establishments on one end, poor settlers on the other
Borsola-Sorsola beel: Commercial establishments. Refinery waste has polluted it
Hansora and Damol beel: No longer exist

Source: Geography department, Guwahati University

The flashpoint

The government reasons that settlements in the hills denuded them leading to massive erosion, and so wants to evict the encroachers. But what was conveniently forgotten was the legalised encroachment by the high and mighty. The first half of June 2011 witnessed eviction drives in many of the 14 forest hills that surround Guwahati. Hutments were demolished, asbestos roofs and water tanks donated during elections taken away. The “encroachers” were not served prior notice of eviction.

This led to massive protests. On June 22, 2011, police opened fire as protesters were planning a roadblock after an unsuccessful attempt to submit a memorandum to the chief minister. Three died, including 10-year-old Ruhul Ali who was shot in the chest.

Ali’s father Yunus lives in Lalmati, a hill that forms the backdrop of the picturesque National Games village constructed in 2007. “I came from Barpeta district to work as a carpenter in Guwahati. Unable to afford the high rent, I moved to the hill nine years ago,” says Yunus. Indigenous tribes such as Boros

The number of migratory bird species visiting Dobka wetland has dipped substantially



Turning a blind eye to urbanisation, officials blame people residing in forest hills surrounding Guwahati for the situation

and Karbis who work as construction labourers, painters, plumbers and daily wagers inhabit the Lalmati hill. “People went to the government asking for *pattas* (land titles). But the police chose to shoot them instead,” says Gogoi of KMSS. “Now they are planning a luxury residential complex that will cut into the same hill,” she says.

“It is the government which has institutionalised encroachments. The land revenue department sees wetlands as revenue generators and neglects the need to conserve them,” Gogoi adds.

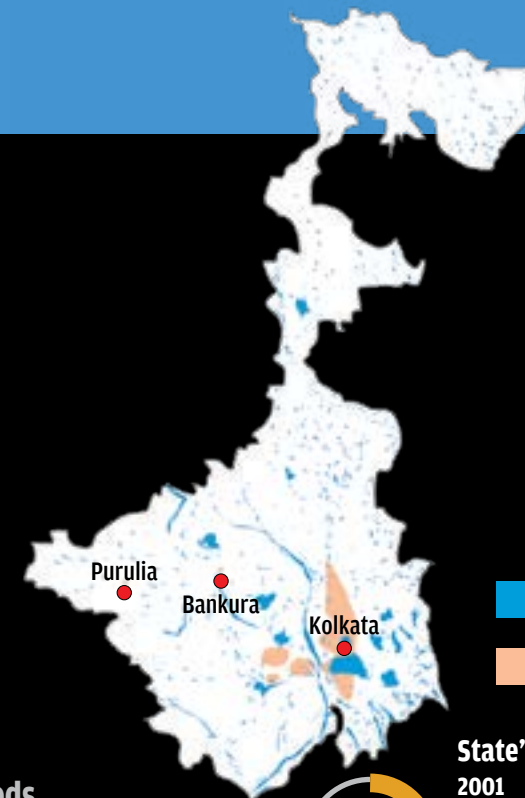
The department has already earmarked the entire Dobka *beel*, next to the Guwahati airport, for a 52-ha complex for Assam Rifles. “It will affect over 500 farm households and 150 fishing families,” says Jafar Ali of Mehnati Krushak Jagran Samiti, a farmer’s group resisting the acquisition.

“Dobka is connected to Deepor. River Kalmani from the hills feeds this wetland. After the complex comes up, neighbouring fields will be submerged and farming will become unviable. We fear even Guwahati airport will get submerged. But no one listens,” rues Ali.

“Borosola-Sorusola and other wetlands which are critical stormwater basins are either polluted or encroached upon,” says Dhrubajyoti Sahariah, who teaches geography at Guwahati University. “Pollutants from the Noonmati oil refinery, owned by the Indian Oil Corporation, have turned the water at Sorusola black. Borosola looks like a garbage dump” (see ‘Shrinking wetlands’).

The other casualty of shrinking wetlands of Guwahati is migratory birds. During winters, Deepor sees some of the largest congregations of aquatic birds in Assam, states Planning Commission’s 2008 report. Because of its rich avian fauna, Deepor has been selected one of the Important Bird Area sites by the BirdLife International. But the count has dwindled. “In the winter of 1989 we had counted 19,000 birds in a day in Deepor. By 2008, the number came down to 3,000,” says the ASTEC official. ■

WEST BENGAL



Total number of wetlands
1,47,826
(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)
5,908

Most urbanised city
Kolkata

Urban floods
Kolkata
5

State's level of urbanisation

2001
27.97%

2011
31.89%

Flash floods on the rise

Kolkata's old canal system, which acted as an effective drainage system for some three centuries, is in disrepair. Many wastewater conduits out of the city such as storm water drains, sewers and canals are silted. Besides, gully pits are blocked and there is a time lag for water to reach the pumping stations. This leads to flooding on the surface. Poor solid waste management, along with an overburden of plastic, is the culprit. The

original design of Kolkata's drainage system was based on the drainage capacity of the sub-basins. But the unplanned diversion of surface run-off from one sub-basin to another is one of the reasons for overloading of the existing drains, resulting in flash floods. In the metropolitan part of the city, the demise of small water bodies has created problems in holding capacity of surface run-off and groundwater recharge.

ATTEMPTS TO SAVE WETLANDS

1992

Non-profit People United for Better Living in Calcutta files a petition in the Supreme Court to close down tanneries near wetlands in East Kolkata. The apex court orders their closure. Later the West Bengal government passes a bill for the protection of wetlands in East Kolkata.

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1995

Petition in the Supreme Court to save water bodies in Howrah. The case is transferred to the Green Bench of the Calcutta High Court. In 2001, the court bans filling up of urban water bodies in Howrah.

2001

The Green Bench of Calcutta High Court orders squatters should be evicted from Rabindra Sarobar. After much protest, the area gets cleared and fenced.

2014

Calcutta High Court appoints a committee to monitor and ensure protection, preservation and beautification of Rabindra Sarobar. There is no sign of compliance of the court order.

2015

Calcutta High Court asks the state government to remove unauthorised constructions in East Kolkata wetlands.

Everybody loves water body

Amid murder of an activist, 4,000 missing ponds and 195 FIRs on encroachments in East Kolkata Wetlands, West Bengal mulls a wetland policy

The composure on Pratima Dutta's face defies what she has endured. Rummaging through a pile of photographs, she takes out one where a girl is walking through a lane submerged in rainwater mixed with sewage. The photograph was taken a few years ago by Pratima's husband Tapan Dutta near their house. Tapan had meticulously collected evidence of how a consortium of contractors, Bengal Anmol South City Infrastructure Ltd, was illegally filling a 280-hectare (ha) wetland near Kolkata. Without the Joypur *beel*, as the wetland is locally known, the low-lying habitations in Bali will face further submergence, Tapan made people understand. He gathered them, formed Bali-Jagacha Jalabhumi Bachao committee and filed a petition in the Calcutta High Court in 2009. Tapan was offered money and a flat to withdraw the case, but he refused. On May 6, 2011, Tapan was shot nine times. With his death, the petitioners fell silent except Pratima.

Owing to encroachments, Bikramgarh jheel in the heart of Kolkata has shrunk from six hectares to three

On January 14, 2013, the court, in its final judgement, allowed construction to continue in the wetland, despite findings by government bodies that the work being carried out is illegal. "It is a big project... cannot be stopped," it said.

In 2011, following the court's instructions, the West Bengal Pollution Control Board (WBPCB) filed an inspection report. The report states: "The entire



area (Joypur *beel*) appears to be low lying marshland with abundant aquatic vegetation... . The site has been exclusively filled with fly ash." A high power committee, constituted by the high court, that visited the site in 2012 said, "The wetland has been serving major ecological functions for more than 100 years... as a natural reservoir of flood water and recharge(ing) the groundwater." The district land and land reforms department had converted the land status of the project area from wetland on which any construction is illegal to agricultural land where construction can be done. The project is yet to take mandatory clearance from the State Environment Impact Assessment Authority or a consent to establish from the pollution control board, said the committee which was formed following a 2011 petition filed against encroachment on wetlands in the state.

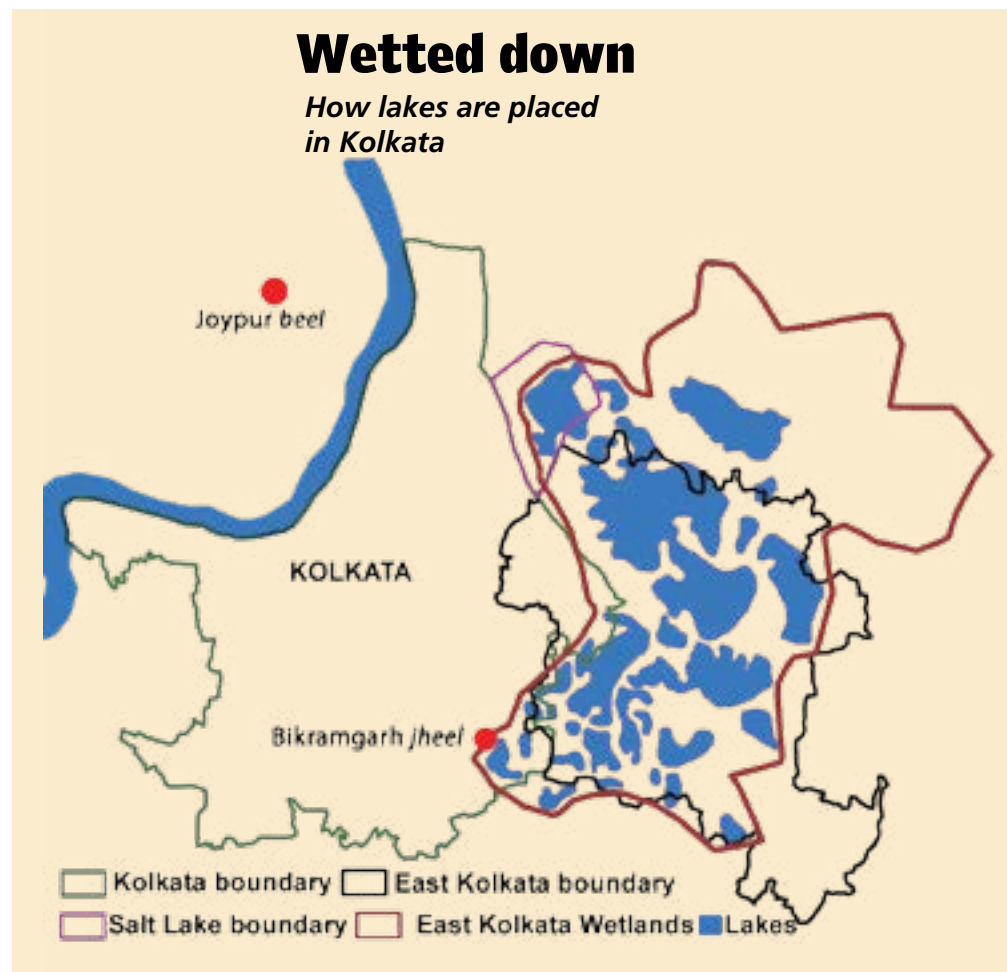
East Kolkata Wetlands nurture the largest wastewater-fed aquaculture system

Although the high court has given its final verdict, Pratima has a long battle ahead. In the criminal case of her husband's murder, she has moved high court, seeking a CBI inquiry. The state CID failed to investigate because of involvement of a state Cabinet minister among others, alleges Pratima who, along with her young daughters, lives under constant threats.

A regular offender

South City Infrastructure, a partner in the construction on Joypur *beel*, is not new to encroaching on wetlands. Starting 2003, it constructed two 40 storey towers by filling 0.4 ha of Bikramgarh *jheel* in the heart of Kolkata.





Witnessing the increase in encroachments, non-profit Vasundhara approached WBPCB in January 2006. Three months later, WBPCB formed an independent committee to recommend corrective measures. The committee said two of the four towers be demolished and held IAS officers and WBPCB's chief engineers responsible for giving permission to fill the wetland. The recommendations, however, were not implemented because of "considerable delay". Over the years, Bikramgarh *jheel* has reduced from six ha to three. "South City paved the way for more encroachment," says Arjan Basu Roy of Nature Mates. The non-profit has reclaimed portions of Bikramgarh *jheel* with excavators. Ironically, South City builders and flat owners pitched in with funds. South City Infrastructure did not give any response on the issue.

Toll on East Kolkata Wetlands

The 12,500 ha East Kolkata Wetlands (EKW) is the only Ramsar site (implying a wetland of international importance) in the state. Managed by statutory body East Kolkata Wetland Management Authority (EKWMA), EKW acts as the city's kidneys. It consists of 250 sewage-fed fisheries and processes nearly 750 million litres of sewage daily. The treated water is used in aquaculture to produce 15,000 tonnes of fish per year and 150 tonnes of vegetables per day. "The key ecosystem service is provided by an interplay of wastewater, sunshine, algae, fish and the creative intervention of farmers.... as a result of this

intervention pathogens within the wastewater get destroyed... the nutrients are entrapped by the algae in presence of abundant sunshine, and finally treated water is released to irrigate paddy fields," writes Dhrubajyoti Ghosh in his book *Ecology and Traditional Wetland practice: lessons from wastewater utilisation in the East Calcutta Wetlands*. Ghosh is the former chief environment officer of West Bengal and an expert on wetlands. In 2014, Kolkata chief minister announced regularisation of illegal construction in East Kolkata Wetland. In 2015, Calcutta High Court asked the state government to remove all the unauthorised construction.

Despite their pivotal role, the wetlands are facing crisis. Since EKWMA's inception in 2006, the authority has filed 195 FIR's and 25 stop-work notices against illegal land conversion and encroachments. On many occasions, the field staff was severely beaten during site inspection, says Bonani Kakkar, non-profit member of EKWMA. The encroachments include educational institutes like Bengal Institute of Technology and Heritage Institute.

In August 2012, EKWMA filed an FIR on a real estate project, Sabujayan, which is selling 100 plots in 8 ha. "Everyone wants a waterfront house with greenery. The real estate industry is providing exactly that at a steep price; the folly being there will neither be water nor any greenery left in a few years," says a senior officer in the state environment department requesting anonymity.

Trucks are used to dump fly ash in Joypur beel



The Salt Lake municipality and the New Town Kolkata Development Authority are dumping solid waste in East Kolkata Wetlands

The Salt Lake municipality and the New Town Kolkata Development Authority, meanwhile, are dumping solid waste in EKW after EKWMA turned down a request for a dumping facility last year. “Without political will, laws are ineffective in stopping the rapidity and rabidity with which wetlands are disappearing,” says Ghosh. It was during his tenure that EKW was notified under the Ramsar Convention. Sadly, says Ghosh, the Ramsar Convention has wide gaps, especially when it comes to monitoring infrastructure. For instance, EKWMA has only 16 staff members—all on contract—headed by an IFS officer. The mobility of the staff members is restricted as they only visit the field with police personnel.

State acts... not

When non-profit Forum for Human, Legal and Ecological rights filed a petition against encroachment at the high court in 2011, it resulted in the constitution of the high-power committee to suggest remedial measures. “We wanted the court to act as wetlands were destroyed across West Bengal despite legal provisions. Tapan’s death was a wake up call,” says Kunal Guha Roy, general secretary of the non-profit. Within weeks of its formation, the committee received 27 complaints. It visited Joypur *beel* and other wetlands in April last year and submitted recommendations to the state chief secretary in August.

The recommendations, which are yet to be made public, include formation of a state-level management authority for wetland and other water bodies, since the existing Acts and rules relating to wetland protection vest with different departments. As the records of wetlands are held by multiple authorities (land and land reforms department, fisheries department and municipal authorities), the committee recommends that the state environment department be charged with the assessment of status of any water body in case of any inconsistency in the records held by different departments.

Among its other recommendations are a “monthly action taken report” against filling of wetlands from district authorities to be sent to the state-level authority, and preparing a detailed inventory of wetland and water bodies in every district. In accordance with the Inland Fisheries Act, all wetlands illegally filled up in the last five years are to be restored, suggests the high-power committee. In spirit of the Forest Rights Act of 2006, the committee recommends legal entitlements to those dependent on the water bodies. A draft state wetlands policy on similar lines was submitted to the state government in July 2012. But nothing has moved since then.

Guha Roy puts it succinctly: “West Bengal was an industrial cemetery for decades and now, real estate has emerged as the frontier sector. There is no political will to unsettle this cash cow.” ■

INTERVIEW

‘Community management of ponds has been a success’

Mohit Kumar Ray, convenor of Kolkata-based non-profit Vasundhara Foundation, says the city has been losing nearly 200 ponds each year for the past two decades. In an interview, Ray, who is an environmentalist by training, says these ponds, called *pukur* in Bengali, are crucial to the city’s ecology. Excerpts:

How many ponds are there in Kolkata and what is their state?

There have been huge discrepancies in data produced by government departments. The Kolkata Municipal Corporation (KMC) has carried out surveys from the early 2000s but is reluctant to release the list of ponds. In 2006, it published a list that said there were 3,874 ponds in the municipal area. But the list did not provide the proper location or size of all the water bodies.

In 2006, the National Atlas and Thematic Map Organisation (NATMO), a government organisation under the Department of Science and Technology, published Atlas of Kolkata with detailed maps. The number of ponds marked in this atlas was 8,731. But the NATMO study was based on a 20-year-old database and, therefore, many of the water bodies it listed actually did not exist.

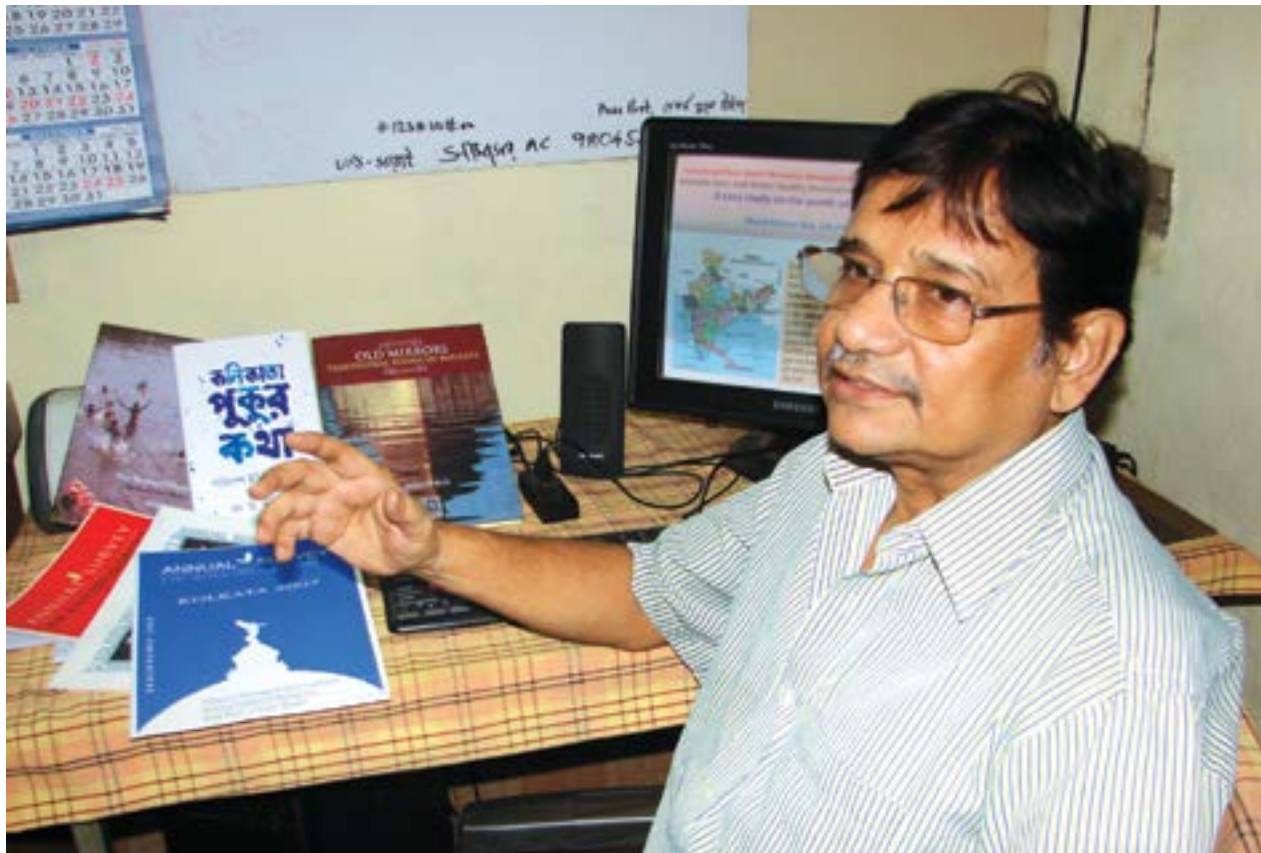
In 2007, our researchers at Vasundhara Foundation used Google satellite images and found that the number of healthy water bodies (those with clean water) was 4,889. Nearly 75 per cent of these ponds are privately owned, but used by communities. However, there has been no initiative after 2007 by any organisation to count the number of healthy water bodies. Considering that 8,731 ponds existed 20 years ago as per NATMO’s study, we concluded that there was a loss of 3,842 water bodies in the last two decades.

I have found that the majority of the ponds are not in good condition due to lack of maintenance and government apathy. Though a lot of them are privately owned, KMC has the right to take over the maintenance of neglected water bodies. Filling up of ponds or dumping of waste by their side is also a common practice. In the past few years, KMC has been more active in maintaining some ponds, but their efforts are not sufficient.

Why are *pukurs* (ponds) important to the city?

Kolkata is a city of *pukurs*. The city’s history can be told through the history of its water bodies. It has many places with the word *pukur* attached to their names. For example, Monoharpukur, Ahirpukur, Bosepukur, Thakurpukur, Paddapukur and Talpukur. There are about 30 streets in the city named after ponds. The city has water bodies called Kamala and Bimala which were named after local ruler’s wives. These ponds are even older than the Taj Mahal.

Around one million people in the city, mostly poor, use its ponds every day.



VASUNDHARA

Eighty per cent of them use it for bathing and washing. Many of these water bodies are used for pisciculture. They also store rainwater and help maintain the water level. The wetlands in the east serve as the receptor for the excess water. These water bodies also act as a centre of social and cultural activities.

What actions have been taken to save Kolkata's ponds?

The city planners of Kolkata never bothered about the ponds. So Kolkata's ponds had never been included in any of the urban water resource planning. KMC does not have any specific department or infrastructure to manage the ponds. Neither does it have an annual programme or budget for pond restoration. It has taken some initiatives to beautify some large ponds but never focussed on restoration. Vasundhara Foundation has played a role in organising and guiding the community movement for protecting and restoring the ponds in Kolkata.

How has Vasundhara done this?

We did a scientific study. It was done in three phases between 2001 and 2007. In the first phase, social- and water-quality surveys of selected ponds were done. In the second phase, we studied the impact of idol immersion on the health of ponds and in the third phase we studied the ecological conditions in and around the ponds.

The study, which was partly funded by the Central Pollution Control Board, found that some of the ponds are being managed very successfully by communities. Lack of technical support from any authority or institution

emerged as the major limitation faced by communities. There is also no network for exchange of information. So groups cannot learn from each other's achievements.

The study developed a water quality standard for the city ponds and identified the need of a financial programme to assist private owners in managing them. We also found that there is a need for capacity building for the city's administrative and planning bodies.

How successful have community initiatives been?

One of our best restoration experiences was at Kazipukur where people from different economic backgrounds got involved physically and financially to save a water body. The process took two-three years and got completed in 2007. Funds also came from the local member of Parliament. The pond is of medium size (0.5 hectare) and is used by people for washing, cleaning utensils and bathing. Prior to restoration, it was just a receptacle of solid waste.

A community organisation was formed and they started the cleaning process. The members included shopkeepers and residents. They all resolved to stop dumping waste in the pond. The pond was cleaned and several truckloads of plastic and garbage was taken out. Then the water was pumped out and the sludge removed. These are small ponds and get filled up by few days of rain.

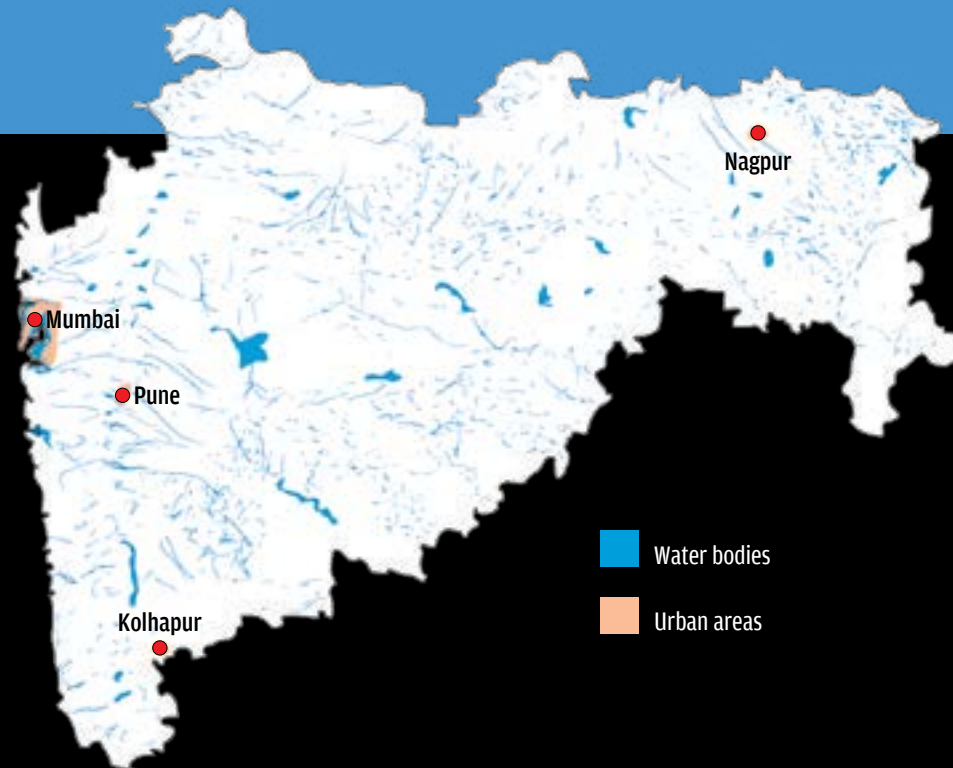
Vasundhara helped the community with technical advice. It was ensured that wastewater did not enter the pond and went towards municipal drains. Separate enclosures were made for washing clothes. Grass and other plants were planted near the banks and it was strengthened with soil and wooden logs.

Do you think the present rules are sufficient to protect ponds?

Ponds, by definition, are a type of wetland. But the Wetlands (Management and Conservation) Rules, 2010, does not address the issues of small water bodies like ponds. The rules mention many services of a wetland but do not mention the use of small water bodies. It thus creates legal problems in identifying a wetland or a water body. These problems are more prominent in urban areas because urban water bodies are not considered water resources though they support a large number of people. ■

Kolkata is a city of ponds. The city's history can be told through the history of its water bodies. Most of them are older than the Taj Mahal

MAHARASHTRA

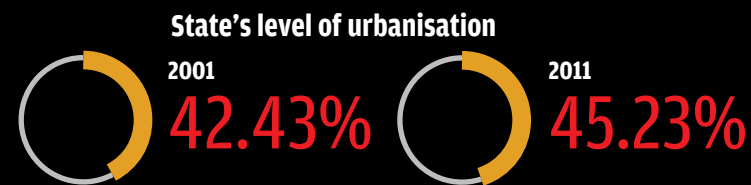


Total number of wetlands
42,978
(including smaller wetlands of area less than 2.25 ha)

Number of lakes/ponds/tanks (both natural and human-made)
23,712

Most urbanised city:
Mumbai

Urban floods (in past decade)
Mumbai 9
Kolhapur 2



No lessons learnt

It took all of 24 hours in a single day in July 2005 for a cloudburst that spurted 944 mm of rain on Mumbai's suburbs for the financial capital of India to be brought down to its knees. The deluge and the aftermath landslides and outbreak of diseases claimed 698 lives. The casualty list also included 24,000 animal carcasses, 20,000

damaged cars, 2,500 buses and more than 1 lakh houses. Ever since, the situation of Mumbai's wetlands has only deteriorated, which means even rains slightly above normal will be enough to flood the city. A case in point is Mithi river that has been reduced to a drain. The clogging of this drain was responsible for the 2005 floods.

ATTEMPTS TO SAVE WETLANDS

2000

Bhrashtachar Nirmulan Sanghatan and local residents file a case for cleaning of the Powai Lake that was constructed in 1891. In 2004, another case is filed against hostels adjoining the lake, which were built without permission. In 2006, the court orders the removal of encroachments.

2009

After successfully removing garbage and debris from the Charkop Lake, non-profit United Association for Social, Educational and Public Welfare moved court to stop encroachment on the lake and save its mangrove cover. However, only 20 per cent of the water body survives today.

2015

State government allocates ₹550 crore for cleaning Mithi river by February 2017. Citizens not happy with the restoration project.

2014

The Bombay High Court orders a ban on reclamation or construction on wetlands in the state. The Brihanmumbai Municipal Corporation unsuccessfully tries to clear houseboats in Powai Lake.

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Don't plug this hole

Residents protest housing projects on lake in Mumbai suburb

It has been 10 years since the July 26, 2005, deluge, but the fear of flood during monsoons still lingers among Mumbaikars. It is especially so among the residents of Mumbai's western suburbs who have been facing severe waterlogging for the past six years. Residents of Charkop in Kandivali West, however, believe that restoring a 50-year-old lake can end their worries.

Since 2006, people from over 10 societies around the Charkop Lake have been campaigning to save the water body which, they say, can absorb the extra runoff during monsoons. The lake acted as a natural drain for the area before it was encroached upon for housing projects in 2005. "This leads to waterlogging and flooding every year during monsoons," says resident Reji Abraham, who is heading the campaign. The lake is a natural ecosystem and helps maintain the ecological and hydrological balance of the area, according to the Bombay Natural History Society (BNHS).

Three housing projects have rendered more than 80 per cent of the Charkop Lake dry



SANVIKTA DASGUPTA/CSE

End of lake

In 1974, the state leased the two-hectare lake for 30 years to a society of potters, called Kumbhar Kala Industrial Society, to make clay pots. Kumbhars, or potters, use wet mud from marshlands for their work. But the society never used the land. In 2004, 1.8 hectares (ha) was leased again to the society, under the name of Kumbharkala Cooperative Housing Society Limited. The remaining 0.2 ha was given to two private housing societies, Sagarmata Cooperative Housing Society Limited and Laxmannagar Cooperative Housing Society Limited. The three societies started filling the lake with debris for construction work in 2005. During the 2005 deluge, the area surrounding the lake was filled with three-foot high water. "At that time the lake was 50 per cent filled," says resident Sunil Gole. Following protests by the residents, the builders temporarily stopped work in 2006.

Since 2006, people from over 10 societies around Charkop Lake have been campaigning to save the water body which, they say, can absorb the extra runoff during monsoons

In April 2009, Abraham, president of local non-profit United Association for Social, Educational and Public Welfare, filed a public interest petition against the state and the developers in the Bombay High Court, saying encroachment on the lake increases the risk of floods. The defendants said the lake could be filled as it is not a natural water body, a claim that Asad R Rahmani, director of BNHS, dismissed. "The lake was once a paradise for fishers," says Rahmani.

The defendants showed official records that said the lake bed is a deep pit that gets filled by the runoff coming from the surrounding highlands. "The Brihanmumbai Municipal Corporation (BMC) even diverted industrial effluents to the lake to prove that it is part of a nullah," says resident Mukesh Mistry. People now live in constant fear of outbreaks of malaria and dengue, he adds. Four months later, the court ordered the developers to construct a stormwater drain near the site. "The judgement did not tackle encroachment," says Abraham. "Worse, instead of the builders, BMC built the drain at the cost of ₹50 lakh using taxpayers' money," he explains. The drain was completed early this year. "BMC has done nothing to protect the lake," Gole says.

BMC officials refused to comment on the matter. At present, the lake is almost 80 per cent dry. Mistry says, "The residents are using borewell water as supplementary source." He points out if the lake is conserved, "it can help tackle the problem of depleting groundwater in the area".

Despite continuing protests, BMC is yet to do anything concrete to avert a disaster like 2006.

INTERVIEW

'Mithi is a river, not real estate'

Post 2015 floods in Chennai, the Bombay High Court expressed concerns over the poor state of mangroves in Mumbai, a flood sink in the city



Jagdish Gandhi wears many hats. A historian writing a book on Mumbai's colonial past, he was among those responsible for restoring the Kutchh palace. He also filed a public interest petition to rescue the Mithi river. He spoke to *Down To Earth* on this petition. Excerpts:

What led you to file the public interest petition?

On July 26, 2005, there was a deluge in Mumbai. It caught the administration unawares; all utility services broke down. I was one of those stranded, who spent the night under a flyover.

I started wading back home at about 4 am. From horizon to horizon, I could see nothing but water. I reached the suburban railway station in Sion and found the platform submerged. What struck me was: the government has plans for an underground rail. I thought if a platform on the surface is under water, what would happen to the underground rail. That night I waded and swam before arriving at an overbridge. I could see the Mithi river in spate. Next I learnt the government had blamed the Mithi for the flood. I had a hunch something was wrong and began researching on the river. The results led me to file the petition.

What did your research show?

I estimated the discharge on July 26, 2005 was 35,000 cusecs. Now 40,000 cusecs is the capacity of the world's largest canal—the Narmada Canal in Gujarat. I found there was nothing wrong with the river. It simply had no exit.



WIKIMEDIA

Maharashtra government blamed Mithi river for the 2005 floods in Mumbai while the main reason was the city's unplanned urbanisation

The river is a channel through which a given amount of water flows. This river had been there for 60 million years. Nobody, including the government, knew it was one of the world's oldest surviving river systems—a river system with tributaries and aquifers.

But the river has been blocked at every corner, there are encroachments, constructions on the riverbed and at the place where the river discharges into the sea. In natural course, the discharge mouth of the river is much wider than the river upstream. But the width at its discharge point has, over the past four decades, gone down from 1,000 metres to 40 metres. So the river could not flow into the sea. Every open area in the city is paved. Where does the water flow?

Will you elaborate on encroachments?

A river flows through a given channel and on its banks are wetlands that take the overflow during the monsoon. In case, the river is discharging into the sea then twice in 24 hours tidal water flows in through the creeks and enters wetlands. So wetlands are reposes of overflow, they sustain the water level to an extent. The wetlands have mangroves, which absorb whatever water they need and the rest of the water percolates. For an island city, Mumbai's water table was pretty healthy till three decades back. You construct a building and there was ample water. Now the water table is sinking. Mangroves have been chopped and alleys cut through them. By allowing construction, the government ignored Mumbai's river system—in fact, it ignored that Mumbai is a city within a river system.

What did your petition plead?

I filed the petition in 2007. Mangroves have been declared as forests by the

apex court. But the Mumbai mangroves are still within the jurisdiction of the revenue department. Why has the government not transferred it to the forest department? The forest conservation and wildlife protection acts should apply to the mangroves—they have varieties of animals, migratory birds and reptiles. Few cities have marine and freshwater life. The petition pleaded there is a deliberate attempt to withhold the transfer of the mangroves to the forest department, so that the forests can be leased out to real estate.

Did the petition draw from history?

It did. The islands that constitute Mumbai have been there for millions of years. They were densely forested once. The city was developed in the colonial period. But the ecological footprint of colonial rule was far less than that of post-colonial regimes. They had taken care that forests were not destroyed. Forests on Malabar hill, Kambali hill and Sewri were intact when the British left. We have plundered them. The British took care that Mithi's water exits were not blocked. The railway bridges were once 600-700 metres wide and now they are just 40 metres.

What has been the progress on your petition?

The court asked me the basis of my statement on the railway bridges. I showed them colonial records. The court then directed an inspection of the entire Mithi river area, including those under the railways.

The deputy chief engineer of the Western Railways was part of the inspection team and he argued the width of the railway bridge is what it was five decades back. I showed him records, which showed even in the 1960s the bridge was 600 metres wide.

I took the investigation team to the area where the International Airport Authority of India has pushed the river out to extend the runway. In court, I asked under what act was this extension allowed. Under the law, you cannot change the course of the river except for constructing a dam. The airport authority has diverted the river at 90 degrees at four places within half a km of its stretch. Rivers don't flow at 90 degrees. They meander like the English letter S. The court has asked the airport authority to explain. It has so far not given an answer.

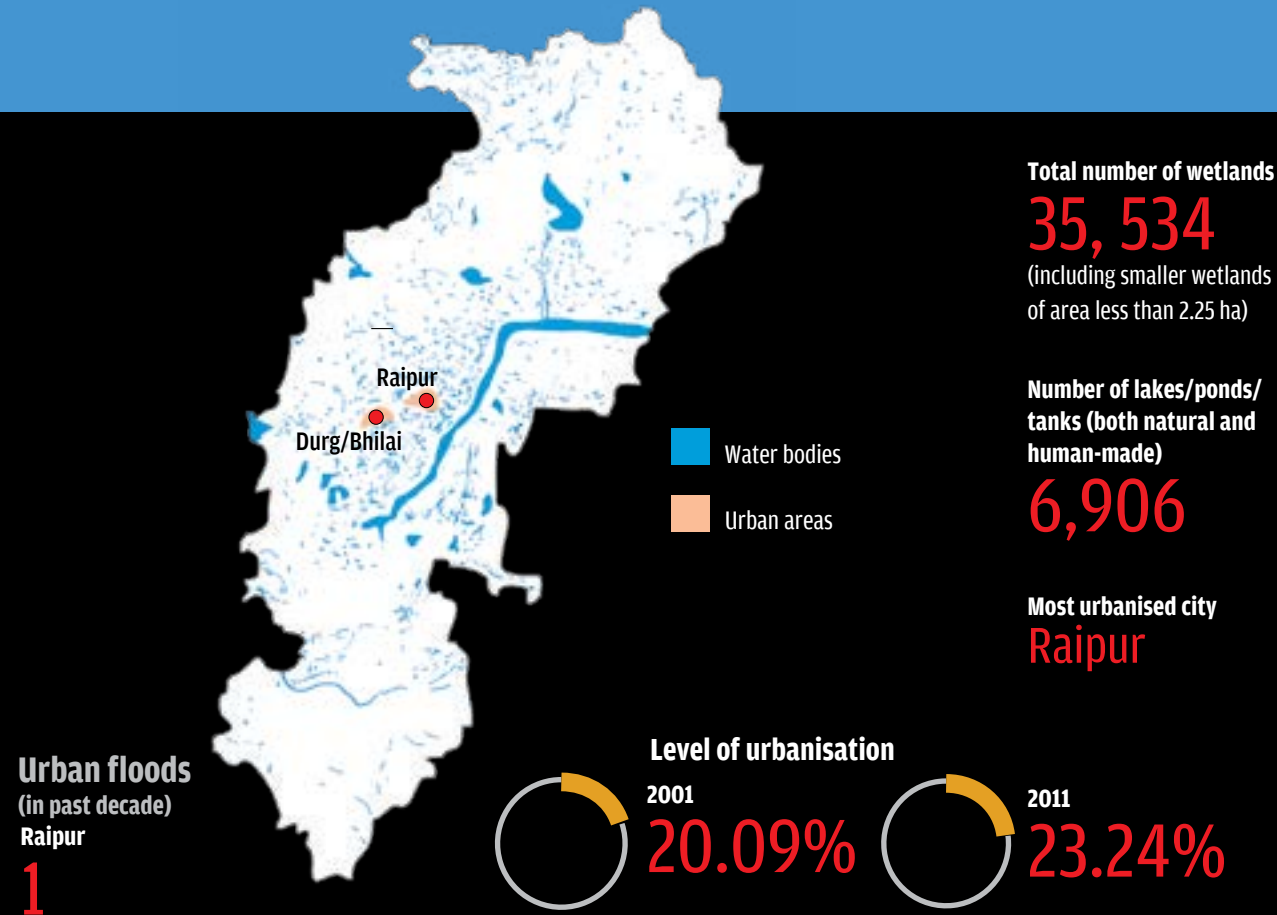
Has the petition improved matters?

Somewhat. Four choked discharges of the river have been restored. The matter came before the courts in May 2007. The monsoons were to hit in two months. Notices had to be sent to the Brihan-Mumbai Municipal Corporation, hydraulic engineers and the irrigation department. I told the honourable courts that monsoons do not respect any adjournment. The court gave five days to the state agencies to get things right. Now there is no flooding.

The court has also constituted a committee of ecologists and experts to look into Mumbai Metropolitan Region Development (MMRD) authority's beautification drive. What is this beautification? Entertainment centres, restaurants? When the court asked MMRD to explain its beautification drive it produced an engineer's report which the court rubbished. It said we want eco-solutions. A committee of scientists and ecologists was formed to find ways to restore the Mithi. The petition's ambit has been widened to every river, every forest, every catchment in Maharashtra so that we don't have to go to the court every time a mangrove is chopped down. ■

Mangroves have been declared as forests by the Supreme Court. But the Mumbai mangroves are still within the jurisdiction of the revenue department

CHHATTISGARH



Waiting for a disaster

Chhattisgarh capital Raipur is urbanising at a rapid pace. And like most urban centres, the city is growing at the cost of its wetlands. The city suffered its first floods in 2015. Soon after, the state government announced that it would revive ponds across the state under the Sarowar-Dharohar Yojana. The government also said it would use the scheme to construct new ponds on government land. News reports, however, suggest that the Raipur Municipal Corporation, which has over 100

lakes, is yet to initiate work under the scheme. In fact, the corporation says the reason for their inaction is that most ponds in the city are private owned and outside their ambit. A 2012 report published in the International Journal of Earth Sciences and Engineering says that the city lost 19.03 per cent wetland area between 1976 and 2006. The amount of water in them decreased by 3.6 per cent, says the report.

ATTEMPT TO SAVE WETLANDS

2009

After conducting inspection of six historic ponds in the capital, Chhattisgarh chief minister directed the civic authorities to complete desilting and cleaning of all the ponds within 25 days. Civic authorities identified 22 water bodies for restoration and conservation. These included Pahadi, Maulimata, Bandhwada, Pahaldava and Kho Kho talaavs.

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CONTENTS

Awaiting disaster

Unplanned urbanisation is killing lakes that have saved Raipur from floods for over 1,000 years

Raipur residents talk about the lakes in their city as if they are a family. Some lakes are *mamas* and *bhanjas* (maternal uncles and nephews), others are sisters, and a few are even married to each other. The city's love for human-made lakes started a thousand years ago, when the rulers of Chhattisgarh started constructing water bodies to ensure steady water supply throughout the year. The oldest lake, Budha talaav, was constructed in the 10th century by Raja Brahma Dev and the most recent one, Telibanda, in 1935.

Rulers continued the trend through the years because they realised this was the only way to conserve rainwater in the area that has non-porous soil. At its peak, Raipur had around 200 lakes.

Today's Raipur is a far cry from its past, with just 40 lakes remaining, many of which are nearing extinction. Official data shows the city has lost more than 100 lakes in the past 25 years or four lakes a year. The reason: unplanned and rapid urbanisation, clubbed with government apathy. "The undulating landscape of the city, which at one point of time was supporting these lakes, has been encroached upon by buildings, leaving no space for water to move. The encroachment on lakes leads to floods during the monsoon," says Ninad Bodhankar, a professor with the department of geology in Raipur University.

In response, the Assembly passed a resolution in 2013, saying that ponds and water bodies are the state's cultural heritage. But it did nothing to conserve the lakes. Instead, the state recognises only three lakes that emulate the age-old water harvesting system.



Almost all lakes in Raipur, including the Maharajabandh talaav, are polluted and heavily silted, says a Chhattisgarh government study

ANUPAM CHARAVARTY / CSE

CONTENTS

Passing the buck

“The Assembly made the resolution and it stopped there,” says former Cabinet minister Ram Chandra Singh Deo, who authored a book titled *Harbadi Main Sabhyata* (Civilisation in a Hurry). It was Deo who predicted 2014’s devastating floods in Srinagar in his book, saying that as human encroachments over the Dal Lake and other water bodies continue, there will be a day when a deluge would wreak havoc. He points out that in terms of number of water bodies, Raipur is no different from Srinagar. And he warns that a similar fate is awaiting the city.

But Raipur Municipal Corporation (RMC), which is responsible for the upkeep of lakes, has found an easy way to wash its hands off the task—by claiming that the dirty ones are “privately owned”. For the irrigation department, the lakes are “too small” to administer. “The land around the lakes has been sold, bought, resold and bought again over the years. But the ownership has not been updated in the revenue records,” says a senior RMC official.

Let alone conserving the lakes, the authorities are, in fact, destroying them. Take the case of Telibanda Lake, which was recently turned into a tourist attraction. In July, 2015, RMC first turned one of its banks into a lakefront—displacing about 300 families of the fishing community—to build parks and restaurants around it. It is now covered with concrete paths, while on the other side of the lake, real estate has come up in a big way.

A Raipur-based journalist, Zia Khan, explains how polluted the water body has become. “There was a drop in the fish catch from this lake even before the buildings came up due to pollution and sewage,” he says. A study conducted earlier this year by Sustainable Sanitation and Water Management (SSWM), an initiative supported by German-government-owned enterprise Gesellschaft für Internationale Zusammenarbeit (GIZ), bolsters Khan’s claim. It shows alarming statistics on the extent of pollution in the water bodies and directly links pollution in the lake to lack of sanitation. “Only eight per cent of the city’s population has the option of door-to-door collection of solid waste and seven per cent of the population dumps waste in the open, which goes to uncovered drains running through the city during the rainy season,” says Varun Shende of Pune-based non-profit Ecosan Services Foundation, which conducted the study for SSWM. The study shows that Raipur lacks scientific landfills and there is an imminent threat of water contamination from the untreated solid waste.

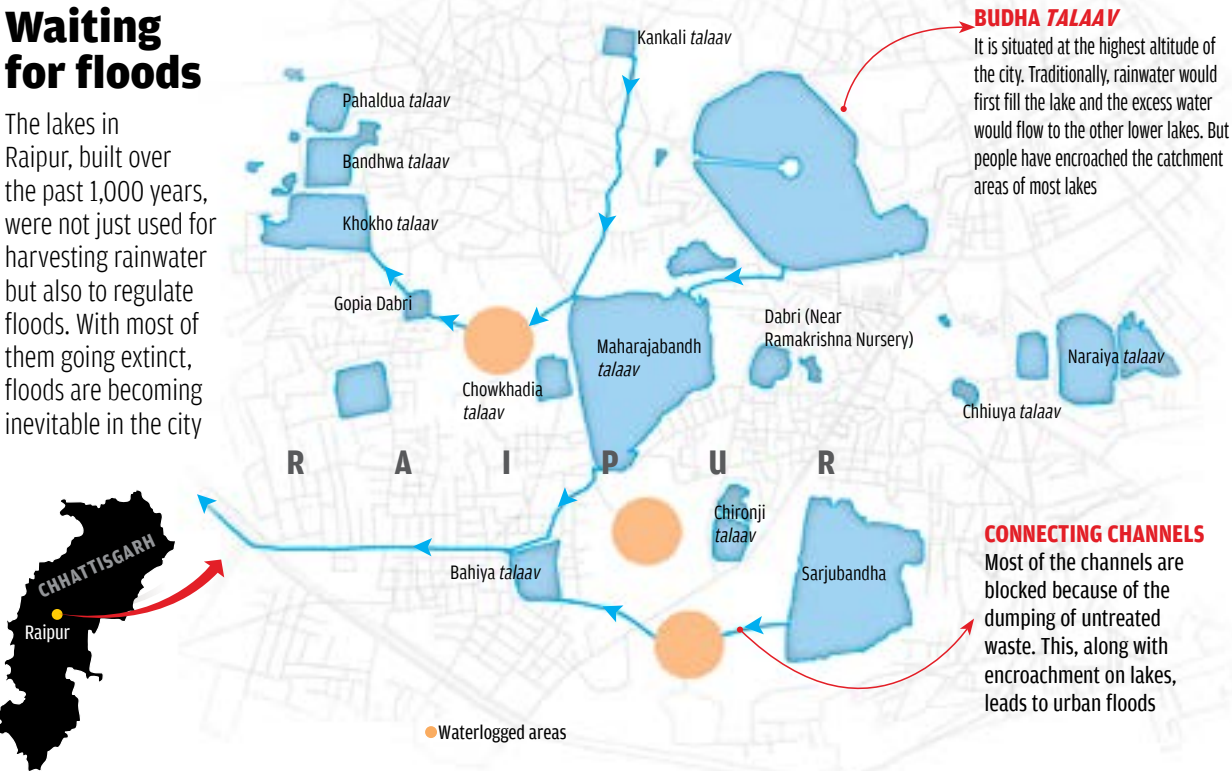
Encroachment at will

Bodhankar says four main industries—oil extraction units, ferroalloy manufacturing units, agro-based industries manufacturing fertilisers and pesticides, and textile units—have contributed to pollution and eventual shrinkage of the lakes. Construction of residential and commercial buildings around water bodies has decreased the soil cover, leading to decreased percolation and increased surface runoff which causes floods. “Increased use of inorganic fertilisers across the landscape, especially rural areas surrounding Raipur, has led to eutrophication of surface water,” he says.

On the other hand, encroachment of wetlands, which form a catchment for many of these lakes, has become a major source of carbon dioxide emissions due to oxidation of large stocks of organic matter. Methane is generated from

Waiting for floods

The lakes in Raipur, built over the past 1,000 years, were not just used for harvesting rainwater but also to regulate floods. With most of them going extinct, floods are becoming inevitable in the city



Tapping the surface runoff

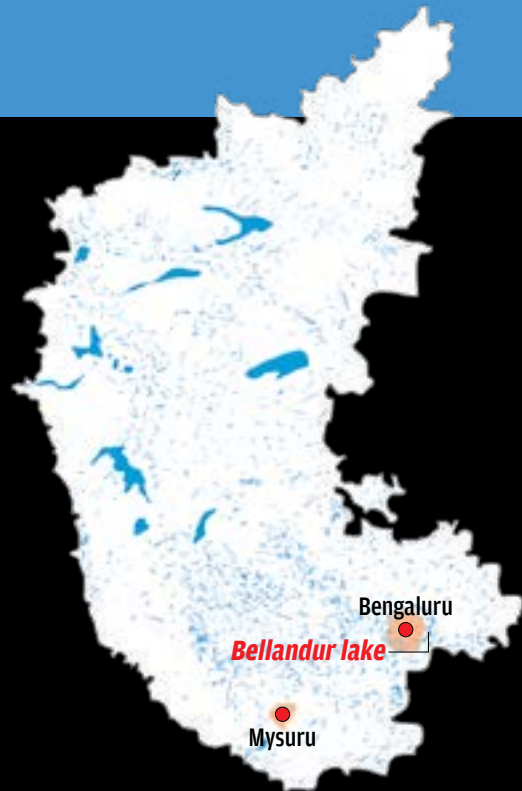
RULERS OF Chhattisgarh since the 10th century understood the topography and soil characteristics of the area and took advantage of that to make water bodies across the city. The top soil in most of the state has shale and sandstone. It is impermeable and helps in water retention. This also means groundwater is scarce. So the rulers, early on, started devising ways to tap surface runoff keeping in mind the scarce groundwater. The first lakes were built on land that remained waterlogged for more than three months. The rulers also wanted to connect the lakes so that every drop of rainwater is conserved. Because of these connections, some lakes were considered married to each, some were called siblings and others were uncle-nephew lakes. Over a period of 500 years or so, planners of the city made water bodies in elevated areas in the direction of descending elevation. Once rainwater or surface water would fill the structure at the highest elevation, it would overflow or spill into the successive structure, leading to conservation of every drop flowing towards the stream or river.

anaerobic decomposition of wetlands, and its impact on climate change is over 20 times greater than that of carbon dioxide over a 100-year period, as estimated by US Environmental Protection Agency.

According to the Chhattisgarh government’s study “Biodiversity and ecosystem analysis with reference to traditional water harvesting systems”, the lakes have also acquired religious significance over a period of time, with temples constructed on the banks and idols immersed in the water. With the growth of residential areas around the temples, the catchment area is highly stressed as older passages for surface flow stand altered. The study revealed that all lakes, spread over 69.239 hectares, are polluted and heavily silted.

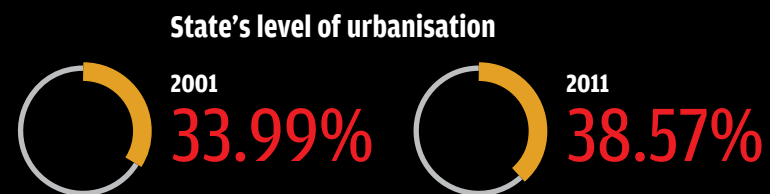
As most experts say the drainage system is directly linked to water bodies, the municipal corporation has to intervene. But as with other municipalities, RMC faces acute staff shortage. In such a scenario, the Chhattisgarh government and its elected members have to do more than just say that ponds and lakes are cultural heritage. ■

KARNATAKA



Total number of wetlands
25,276
(including smaller wetlands
of area less than 2.25 ha)

Number of lakes/ponds/
tanks (both natural and
man-made)
10,413



Urban floods (in past decade)
Bengaluru
4

City with most water bodies
Bengaluru

Choked to death

Urbanisation has literally choked Bengaluru's water bodies. A latest field survey of Bengaluru lakes shows that nearly 66 per cent of lakes are sewage fed, 14 per cent are surrounded by slums and 72 per cent showed loss of catchment area. Also, lake catchments were used as dumping yards for either municipal

solid waste or building debris. In the sixties, the number of lakes and tanks in the city stood at 262 (and the spatial extent of Bangalore was 112 sq km). However, the number of lakes and tanks got reduced to almost 30 per cent in 1980s.

ATTEMPTS TO SAVE WETLANDS

1996

Bellandur gram panchayat files first public interest petition to prevent pollution of the Bellandur Lake, which is the largest Bengaluru lake. The Karnataka High Court in 1999 orders for proper sewage treatment plant for villages in the Bellandur area. But dumping of untreated sewage continues.

2008

Environment Support Group, a non-profit, files a petition against the state government's 2007 decision to allow privatisation of lakes.

2012

In 2012, the high court allows privatisation with certain conditions. The court directs the setting up of District Lake Protection Committees and State Level Apex (Appellate) Lake Protection Committee.

2015

National Green Tribunal fines two Bengaluru companies ₹189.8 crore for illegal construction on wetlands. It also halts all approvals given by the government agencies for construction of buildings on wetlands and catchment areas of water bodies in Bengaluru.

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CONTENTS

Lost lakes

Even contempt notices from Karnataka High Court are not enough to make the state government start lake conservation

Bengaluru, once a city of over 2,500 lakes, has lost most of them to encroachment and construction activity. And this has been possible because of the lackadaisical spirit of the Karnataka government. After all, how else can one justify the state government's failure to conserve water bodies despite repeated reminders by the people, environmentalists—and even the Karnataka High Court. In August 2013, a division bench of the Karnataka High Court, constituted by Mohan Shantanagoudar and B Sreenivase Gowda, asked Karnataka chief secretary why action should not be initiated as per Contempt of Court Act, 1971 for not complying with the directions of the court in the Environment Support Group (ESG) and ANR v State of Karnataka represented by Chief Secretary and ORs, more than a year after the order was passed. In the April 2012 case, the court had directed various functionaries of the Karnataka government and local governments to ensure that District Lake Protection Committees and State Level Apex (Appellate) Lake Protection Committee were set up immediately so that public at large would be able to seek appropriate remedies to stop the widespread encroachment, pollution and destruction of lakes in Karnataka. It had also issued a direction to ensure that the public did not have to approach Courts and that necessary relief could be secured locally and immediately. The court had affirmed that the detailed

Over two-thirds of Bengaluru's lakes have lost large parts of their catchment area



LEO SARDANHA

CONTENTS

guidelines for “Preservation of Lakes in the City of Bangalore” prepared by the court-appointed committee chaired by N K Patil would be binding for survey, protection, rehabilitation and wise use of all lakes and *raja kaluves* (canals) across Karnataka. To ensure that their orders were obeyed, and with due urgency, a specific direction was issued to the Chief Secretary.

The 2012 verdict came in a 2008 public interest litigation that was filed by ESG, a Bengaluru-based non-profit, seeking effective administration of Hebbal, Nagawara, Vengaihkere and Agara lakes in accordance with the public trust doctrine. The doctrine states that the government must maintain certain resources for public use and protect free right of access.

The problem started after the Lake Development Authority (LDA), set up in 2002, decided to lease area around the four lakes to private developers for 15 years to conserve and commercially exploit the regions. In 2004, LDA leased out the Nagawara lakefront to a private developer. Two years later, Hebbal lake was also leased out for a monthly rent of ₹800,000. The idea was to allow developers to finance the rehabilitation of the lakes, create recreational spaces and charge an entry fee to recover costs. The authority planned to use the rental revenues to curb pollution in the lakes.

What ails Lake Development Authority?

LDA was constituted as a registered society in 2002 by Karnataka to conserve and protect the lakes in Bengaluru and neighbouring area as the city was losing water bodies due to urbanisation and pollution. Currently, its main function is limited to giving clearances to detailed project reports of lake development projects to different authorities. However, it has been authorised to undertake many other tasks, says S R Nagraj, executive engineer with LDA. These include preparing environment impact assessment studies of projects proposed on lakes, environmental planning, GIS mapping of lakes, monitoring and management of water quality and lake ecology, and restoring lakes, Nagraj adds.

“The toothless LDA is contributing to a slow death of lakes,” says Leo Saldanha, coordinator ESG, a Bengaluru-based non-profit. It recently failed to clear encroachments of Chikkalasandra Lake, the only water body in Bengaluru South *taluk*, which has completely dried. The lake is in the custody of Bruhat Bengaluru Mahanagara Palike, which has laid a road on the lake bed. The case shows the utter helplessness of LDA in dealing with such matters. However, how effective will the new authority be is yet to be seen because its structure and composition leave a lot to be desired, says Saldanha.

Blame game

Agara, Bellandur and Varthur lakes are facing the dual threat of pollution and encroachment

Bengaluru, the city of lakes, is making headlines for all the wrong reasons. In May 2015, the city’s Varthur Lake made news when huge masses of foam were seen floating on its waters. Experts say raw sewage flowing into the lake caused the foam to form. A few days later, media was abuzz with reports of the foam in Bellandur Lake catching fire.

Agara, Bellandur and Vathur lakes are connected to each other and the flow of one lake passes on to the other, says Shridhar Pabbisetty, chief executive officer of Namma Bengaluru Foundation, a Bengaluru-based non-profit. Pabbisetty explains that a huge amount of sewage flows from Bellandur Lake to Varthur Lake because of the failure of Bangalore Water Supply and Sewerage Board (BWSSB) to manage the sewage of the city.

By the 1980s, untreated sewage and effluents had filled the Bellandur tank, which a decade back had provided water to 18 villages

Vaman Acharya, chairperson of Karnataka State Pollution Control Board (KSPCB), also blames BWSSB for mismanagement of the sewage. He says oil continuously spills into the Bellandur Lake from the garages and motor service centres along its banks. Methane gas produced from the heavy load of sewage is unable to escape into the atmosphere due to heavy accumulation of foam over



KANNANOKANNAN

The Lake Development Authority has little legal powers to save Bengaluru lakes

the water body. In such a situation, any small trigger is enough to cause a fire, explains Acharya.

Leo Saldanha, coordinator of Bengaluru-based non-profit Environment Support Group (ESG), explains that the main problem is the lack of a sewage management plan for the city. Acharya says around 600 million litres per day (MLD) of sewage is diverted to the sewage treatment plants near this three-lake system. Only 200-220 MLD sewage gets treated and the rest flows into the lake system.

Authorities deny hand in lake pollution

KSPCB says that the pollution in the lakes is only due to dumping of domestic sewage. There are 14 industries in the area around Bellandur Lake. But the state pollution control board, which is in charge of monitoring the pollution of these industries, claims they are managing their waste and not dumping anything into the lake system. But BWSSB, which is in charge of managing domestic sewage, blames the industries for the pollution.

KSPCB, which monitors the water quality of the lakes, says that the water in the lake is loaded with domestic sewage and that there is no stress of any heavy metals on the lake's water. The water quality of the lakes is not even suitable for outdoor bathing. The Biological Oxygen Demand (BOD) of the lake is much higher than the standard value set by Central Pollution Control Board for outdoor bathing (3 mg/l). A report by KSPCB shows that the Bellandur Lake

Traditional users like fishermen cannot access Nagawara Lake for their activities now



NITYA JACOB / CSE

had consistently high BOD during the dry period (January-February) between January 2013 and January 2015. It never went below 7mg/l during this period. There were also traces of total coliform in the lake's water. Meanwhile, a 2015 report by the Comptroller and Auditor General of India says that various agencies, including the Lake Development Authority (LDA) and other bodies assigned the tasks of preserving of water bodies, have become ineffective and have allowed encroachment and degeneration of lakes. The city's lakes are facing the dual threat of pollution and encroachment. Bellandur, a 130-year-old water body, is part of the Bellandur drainage system that drains the southern and the southeastern parts of the city. Water from this tank flows further east to the Varthur tank, from where it goes down the plateau and eventually into the Pinakani river basin.

In the 1970s, people from 18 villages depended on the waters of this tank. But by the 1980s, the chain of tanks feeding Bellandur had broken up. Rainwater did not recharge the tank. Instead, untreated sewage and effluents flowed into the water body. In 1997, fisher folk groups from Yemlur, Kempapura and other places filed a petition against the then chief minister of the state as the polluted tank was affecting the fish yield. The petition was passed on to the fisheries department, which released fishlings into the tank to increase their production. But the fishlings did not survive.

In 1999, the Karnataka High Court ordered BWSSB to supply potable water to residents in Bellandur and to ensure treatment of sewage. But nothing changed. A contempt petition was filed. The case is pending before the Lok Adalat. Recently, there was a huge protest by village residents to make the lake encroachment-free.

T V Ramachandra of Centre for Ecological Sciences at the Indian Institute of Sciences, Bangalore, says that Bellandur also faces the threat of an upcoming Special Economic Zone. When the project becomes operational, it will not only encroach upon the lake bed but also increase the threat of flooding in the area. A break in the connection between the lakes will lead to the loss of Rajakaluve (storm water drains) and, hence, it will not be possible to manage the overflow of the lakes.

LDA is awaiting reconstitution as Lake Conservation and Development Authority so that it may have legal powers to save lakes from encroachment and pollution. But it says that only legal powers won't be enough to tackle the problem of mismanagement of the lakes. E E Nagraj, a senior official of LDA explains, "Bellandur Lake is under different agencies. The drains that bring in rainwater are managed by Bruhat Bangalore Mahanagara Palike (BBMP) and the catchment of the lake is under the revenue department. An integrated plan has to be in place involving BWSSB, BBMP, revenue department and LDA to save lakes like Bellandur." ■

Saving city lakes

To counter the rapid decline of its lakes, Karnataka is creating a new authority with powers to fine and imprison encroachers and polluters. Will it be able to reverse the trend?

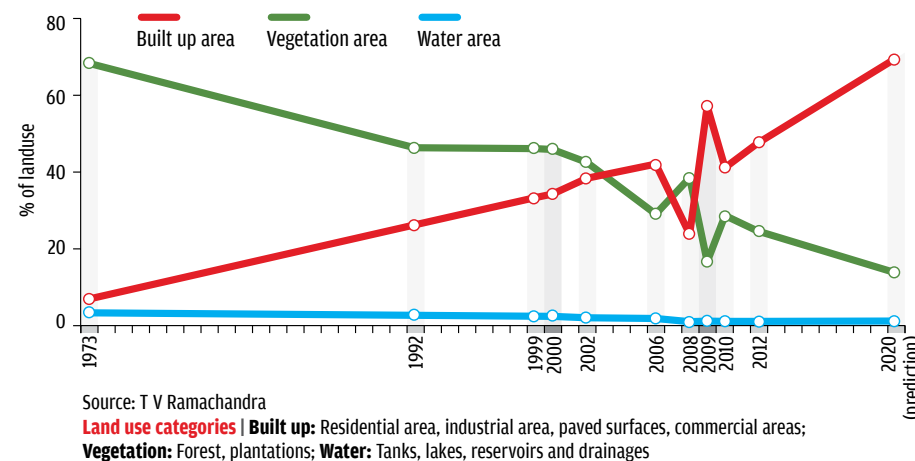
On October 28, 2015, the Law Department cleared the Karnataka Lake Conservation and Development Authority Bill (2014) that was passed by the Legislative Assembly of Karnataka on February 9, 2015. The bill provides for a Karnataka Lake Conservation and Development Authority. It will replace the Lake Development Authority (LDA), which has not been able to check the decline in the number of lakes or the deterioration in the quality of water. LDA chief executive officer C K Shivanna says the body is toothless because it lacks legal power. The new Bill seeks to address this shortcoming. According to LDA, the bill is in the process of becoming a rule.

“The number of lakes in Greater Bengaluru has drastically reduced due to anthropogenic factors. From 207 lakes in the 1970s, the number came down to 93 in 2010,” says T V Ramachandra of Centre for Ecological Sciences, Indian Institute of Sciences, Bengaluru.

Lakes such as Madiwala, Bellandur, Horamavu, Akere, Ulsoor and Hebbal are covered by weed as sewage is allowed to flow into them. More than 50 per cent of the lakes in the city have been encroached, says Ramachandra. A survey he did in 2007 showed that 72 per cent of lakes in Greater Bengaluru have seen a loss of catchment area. His research predicts that if the urban sprawl continues to grow at the current rate, Bengaluru may lose its water bodies, green cover and open spaces by 2020 (see ‘On a downward spiral’). Setting up a new authority is, therefore, a welcome step, he says.

On a downward spiral

By 2020, the coverage of water bodies and vegetation in Bengaluru will become negligible



New set up

The new authority will function through a 16-member governing council, chaired by the chief secretary, and an executive committee. The governing council will also have three government-nominated environment experts. Its jurisdiction will extend to all water bodies within the limits of all the city corporations in the state and any other water body of the state identified by the government. LDA, on the other hand, had jurisdiction only over water bodies in Bengaluru and those water bodies in the state which are a source of drinking water. The most important difference between the two authorities is in their punitive powers. While LDA was not even empowered to remove encroachments, the new authority can remove encroachments, impose fines of ₹10,000 to ₹20,000 and imprison violators for three to five years.

Gaps in the Bill

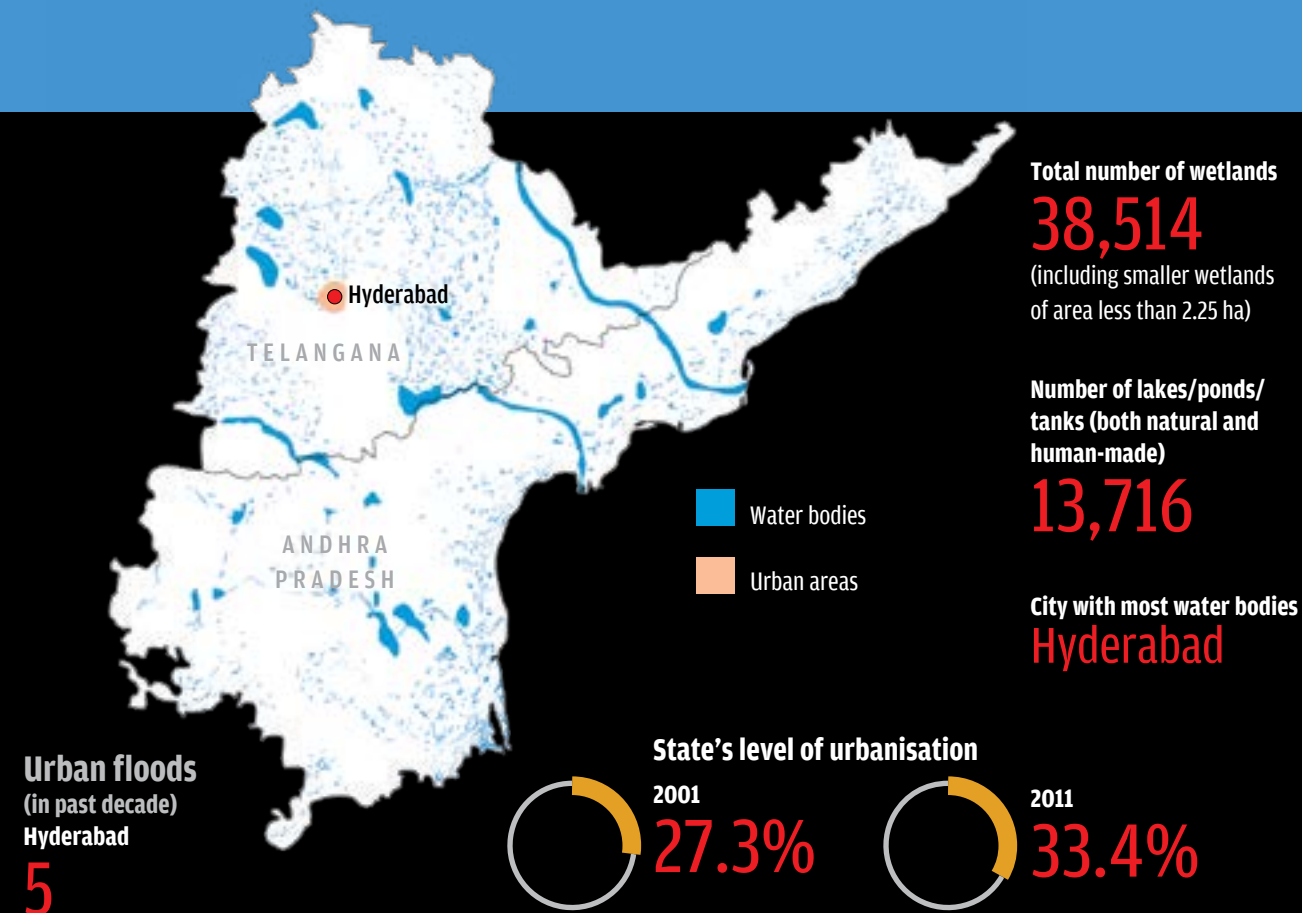
Despite the changes, there are doubts how effective the new authority will be. Leo Saldanha, coordinator of Bengaluru-based non-profit Environment Support Group (ESG), says government-nominated experts in the governing council can be removed by the state government. This will prevent them from interfering in controversial matters, he says. He also says that the Bill allows the new authority to utilise or allow the usage of the lakes for drinking water, fishing, irrigation, education, tourism or any other purpose it deems fit. This will give it a free hand to lease out lakes to developers or hoteliers for development as has been happening under LDA.

Further, there is no role of panchayats in the new authority. The Bill also ignores District Lake Protection Committees and State Level Apex (Appellate) Lake Protection Committee, which were constituted under the 2012 direction of the Karnataka High Court to provide people a platform to seek remedial measures against problems of encroachment, pollution and destruction of lakes. The aim was to settle grievances locally and promptly.

Shridhar Pabbisetty, chief executive officer of non-profit Namma Bengaluru Foundation, also says lack of legal power is not the main problem and even if LDA was given legal powers, the situation would not improve. But Sukhdev Singh, chief executive officer of Delhi Parks and Gardens Society, which comes under the Government of Delhi and coordinates management of parks and gardens in the National Capital Territory, has a different view. He says legal powers are crucial to make such an authority effective. He says water bodies in Delhi are under different agencies for whom conservation is not a priority and Delhi, too, is trying to set up a water bodies protection and development authority.

His view is supported by Malik Tariq, public relations and awareness officer of Lakes and Waterways Development Authority, a body constituted for the protection of Dal and Nagin lakes of Srinagar, Jammu and Kashmir. The authority operates effectively to conserve the Dal and Nagin lakes. He says it is difficult to take action against polluters and encroachers without effective powers. “Only sending notices to violators does not serve any purpose.” This is exactly what the problem with LDA was. It had served notices to many land grabbers in Bengaluru but could not take action. ■

ANDHRA PRADESH & TELANGANA



Flash floods on the rise

Floods are not new to Andhra Pradesh and Telangana. In fact the first recorded floods in Hyderabad happened in 1908, which left more than 15,000 dead. On August 24, 2000, the city witnessed the worst calamity in the past 50 years after it rained continuously for just one day (240mm). According to news reports, 90 residential areas were under water (in some places under 10 to 15 feet) and major chunks of several important city roads were washed away.

One of the major reasons for the city's inability to cope with the heavy rains in 2000 was the gradual urbanisation of the city. Hyderabad lost over 404 lakes, which worked as sponges during floods, between 1982 and 2012. Consequently, the water spread area of these lakes was reduced from 14,005 ha to 11,066 ha. In the last 30 years, the area under the water bodies has been reduced by almost 5 per cent.

ATTEMPTS TO SAVE WETLANDS

1995

K L Vyas, convener of the Save the Lake Campaign, files a public interest petition in the Andhra Pradesh High Court. The petition against Andhra Pradesh government sought the protection of 170 lakes in Hyderabad.

2010

The Hyderabad Metropolitan Development Authority (HMDA) launches a campaign for the conservation and restoration of lakes in the city. It also tried to protect city wetlands from encroachments and pollution.

2015

The Lake Protection Committee of HMDA announces notification of 23 lakes for protection. HMDA had earlier notified 415 lakes for conservation in 12 phases. But construction activities continue on the lake beds.

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CONTENTS

Dry cleaning Hussainsagar

Telangana plans to first empty Hyderabad's great lake and then refill it with rainwater. Experts say it is nothing but a hare-brained plan

Call it his farsighted idea to restore the health of a lake or plain blunder, Telangana Chief Minister K Chandrasekhar Rao is determined to clean up the fabled Hussainsagar first by emptying it and then refilling it with rainwater. In February, 2015, Rao directed the Greater Hyderabad Municipal Corporation (GHMC) to start pumping out the water and clean the 16th century lake before monsoon arrives. But after criticism, Rao in December 2015 put the plan on hold. State officials say that more study would be undertaken before the plan would be rolled out.

The moment the plan was made public, it faced severe criticism from conservationists and people alike. For one, emptying a lake that spans 141 hectares with a depth of over 500 metres is a humongous task, says Jasveen Jairath, founding convener of Hyderabad non-profit Save Our Urban Lakes (SOUL). Removing 22.6 billion litres of water requires round-the-clock pumping for up to 50 days, admits an official of the Hyderabad Metropolitan Development Authority (HMDA). This translates into hundreds of crores of rupees. Since the government is yet to make public the detailed project plan, no one knows where and how the lake water will be released. Conservationists say the water may be released into the Musiriver, that flows 9 km south of the lake. In that case, the murky water of Hussainsagar will further pollute the Musi, the water of which is not fit for bathing, say SOUL activists.

Hussainsagar has shrunk by 40 per cent over last 30 years. Instead of runoff water, it is now mostly fed by drains

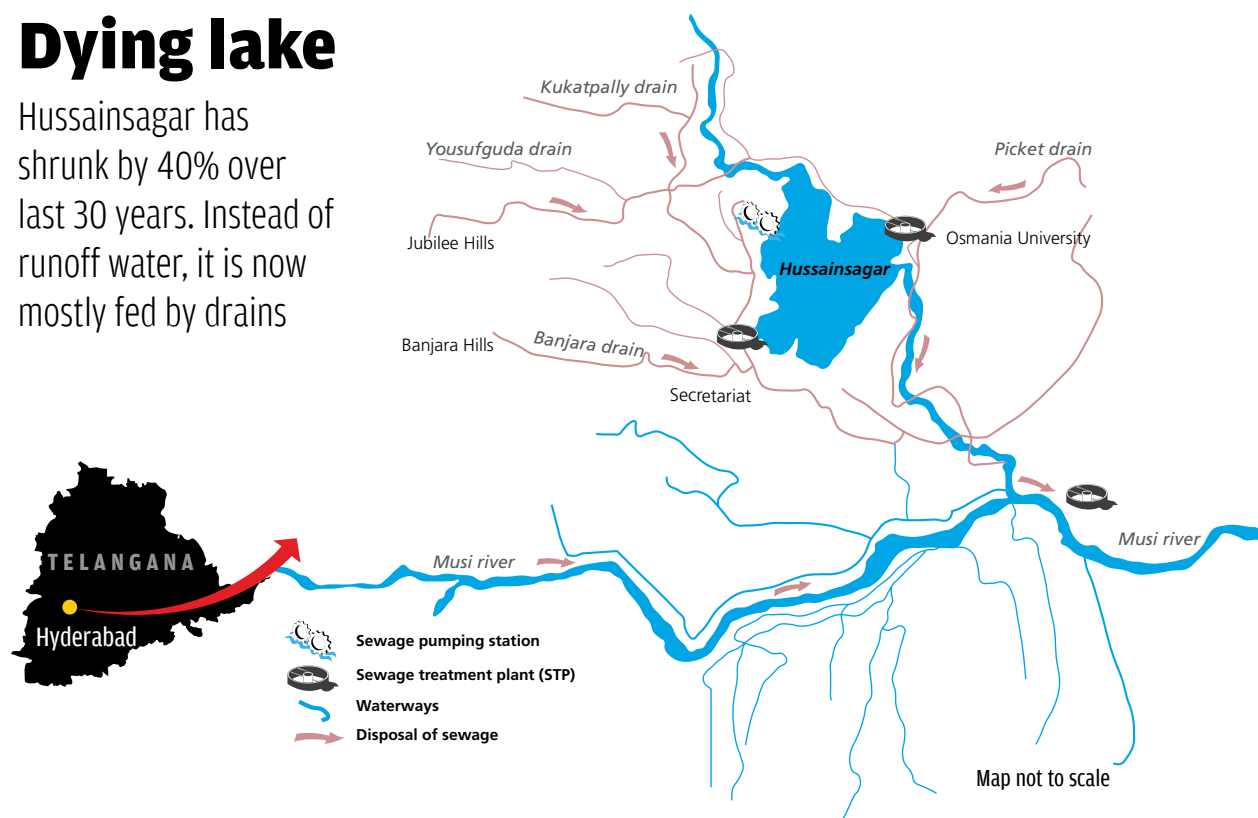


ALOSH BENNETT

CONTENTS

Dying lake

Hussainsagar has shrunk by 40% over last 30 years. Instead of runoff water, it is now mostly fed by drains



Impractical clean-up plan

220,000

trucks, each of 25 tonne capacity, would be needed to remove 4.4 million cu m of sludge over four years

22.7

billion litres of water needs to be pumped out. For this, water has to be removed round-the-clock for 50 days using pumps of 1,800 HP capacity

10

days of continuous rainfall in the monsoon can refill the lake. This is less likely as the region has lately faced rainfall deficit, drought

“We have emptied and refilled small ponds in Kolkata to restore the health of the water bodies,” says Mohit Roy, environmentalist and president of Kolkata-based non-profit Vasundhara. But using the method to restore the health of Hussainsagar seems impractical. Ecosystem of small ponds is simple while that of lakes is complex. Pumping out Hussainsagar requires a complex management of the biodiversity of the lake, Roy adds.

Cleaning up the lake through this crude method is infeasible for another reason: it involves dredging out the sludge that has remained deposited on the lake bed for over 450 years. SOUL estimates that the lake built by Ibrahim Quli Qutub Shah of Qutub Shahi dynasty for providing drinking water to the city could be holding 4.4 million cubic metres (cu m) of sludge. Given that earth-movers can dredge a maximum of 1 million cu m of sludge a day, it would take four years to complete the task. For transporting this amount, 220,000 trucks, each with

a capacity of 25 tonnes, need to be pressed into action.

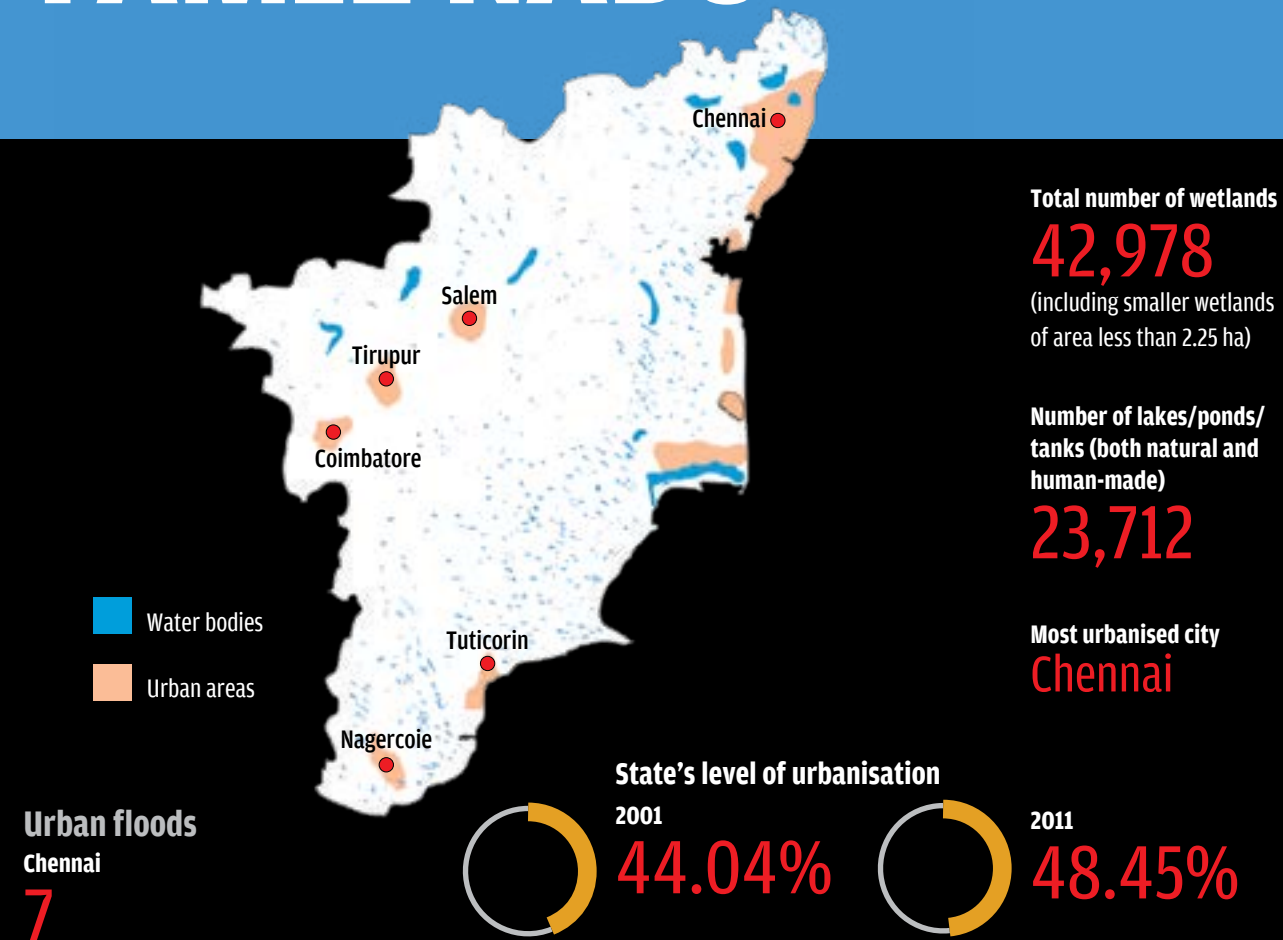
Besides, desilting is not a simple process, warns Hyderabad-based environmentalist K P Reddy. It is not feasible to desilt immediately after emptying the lake as high moisture content of the sludge would not allow movement of earth-movers. Since physical and chemical composition of dredged material is complex, Reddy suggests that the government should conduct scientific studies about its properties, identify stabilisation mechanism, and then specify the mode of disposal. If disposed off without protective lining, hazardous wastes and faecal matters present in the sludge would contaminate surface water and groundwater.

But such a scenario seems unavoidable as there is little coordination between GHMC, responsible for keeping the lake water clean, and HMDA, which works on catchment restoration. The Superintendent Engineer (Lakes) of HMDA, B L N Reddy says GHMC has not kept his department informed about the restoration plan of Hussainsagar. Shailendra Joshi, principal secretary of the Irrigation Department, cites another reason why Rao’s dream project would fall flat. Filling the lake only with rainwater is impossible as most of the runoff gets obstructed due to poor drainage network in the catchment. Joshi’s statements are corroborated by a study by Rammohan Reddy of Jawaharlal Nehru Technical University (JNTU), Hyderabad, who found that the lake’s surrounding area does not have a good network of stormwater drains. Even if HMDA revives the entire catchment and redirects the runoff towards the lake, *Down To Earth*’s assessment shows it will take 10 days of continuous rainfall in the monsoon to fill up. But this is less likely as the region is increasingly suffering from rainfall deficit and recurrent droughts.

Moreover, chief minister Rao’s dream to restore the health of the lake is likely to remain just that—a dream—unless the authorities manage the flow of municipal solid waste from surrounding residential and industrial areas (see ‘Dying lake’). Every day, 78 million litres of sewage and 15 million litres of industrial effluents flow into the lake through four drains, as per Andhra Pradesh Pollution Control Board (APPCB) data of 2012-13. The two sewage treatment plants (STPs) near the lake are insufficient to handle the wastewater load, say SOUL activists.

So, instead of undertaking an ambitious project, the need of the hour is to understand what plagues Hussainsagar. In last three decades, the lake has shrunk by 40 per cent, primarily because of encroachment by both public and private agencies, according to non-profit Forum for a Better Hyderabad. To save the lake, conservationists, including K L Vyas, convenor of Save the Lake Campaign, have moved the High Court of Andhra Pradesh several times, but to little avail. In 2000, the Hyderabad Urban Development Authority issued a notification to protect the lake, but there have been instances where it gave in to the real estate lobby and allowed residential colonies on the catchment. In 2006, HMDA initiated Hussainsagar Lake and Catchment Area Improvement project and set up STPs and wastewater interception and diversion structures. It also installed fountains to aerate the lake to improve its water quality. But these measures are lying defunct. Maybe, Rao should revisit these unfinished plans first. ■

TAMIL NADU



Watered-down

The Pallikarni marshland, situated 20 km south of Chennai, has long worked as a flood sink for the city. But during the December 2015 floods, the marshland could do little. The reason: just 600 ha of the marshland, which was spread across 5,000 ha, remained by 2006. The marshland today doubles as a waste disposal site

and houses several residential and commercial projects. A portion of the marshland has also been allotted to government agencies including the Mass Rapid Transport System of the Ministry of Railways, the National Institute of Ocean Technology, the Chennai Corporation, and the Centre for Wind Energy Technology.

ATTEMPTS TO SAVE WETLANDS

2007

P Raju, president of Welfare Association of Chembarambakkam Lake Drinking Water Consumers in Chennai City, files a public interest petition against the state government's proposal to build an industrial park near Chembarambakkam Lake. In 2007, the court gives an interim injunction on the construction. In 2008, the state government announces second master plan of Chennai city that changes the land use of the area around the lake for agriculture.

2009

Madras High Court gives out orders to stop solid waste dumping in Chembarambakkam Lake.

2015

Tamil Nadu High Court says that maladministration in preserving water bodies, waterways and canals resulted in the huge losses during the 2015 floods. It says authorities in power cannot destroy the water bodies or water courses, which had formed naturally, for the benefit of mankind forever.

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Chennai apart

From ignoring warnings to delays in taking actions, Tamil Nadu administration played its part in making the December 2015 floods more devastating

On December 1, 2015, houses on the ground floor in Jaffer Khanpet, a neighbourhood in southern Chennai, started to inundate because of torrential rains. By five in the morning, almost 80 per cent of the city was under four metres of water. The situation continued for the next 72 hours, killing more than 500 and destroyed infrastructure worth ₹500 crore. It was most intense of the three spells that had battered the city in just one month. Earlier, the city had received incessant rains from November 11 to 13, and then from November 15 to 17.

Chennai received 1,200 mm of rainfall in November 2015, which was the highest rainfall the city received in November in the past 100 years. The city on an average receives 407.4 mm rainfall in November. On December 1, Chennai received 300 mm rainfall, making it the wettest December day ever recorded in the city. The normal rainfall for Chennai in December is 191 mm.

A closer look suggests that the intensity and the resultant losses due to the recent floods could have been greatly reduced. Tamil Nadu faltered on several accounts. Firstly, it failed to act despite a clear warning from the India Meteorological Department (IMD) of heavy rains. Secondly, the state administration has over the years done little to prepare for disasters despite being flood-prone. Thirdly, Chennai and its neighbouring areas have witnessed unplanned urbanisation in recent years that has destroyed the city's natural flood sinks such as marshlands and river channels.

Most of the ground floor residences in Chennai got flooded after the heavy rainfall on December 3, 2015



PHOTOGRAPH BY ARUN SHARMA

IMD in mid-October issued a forecast that predicted 11-12 per cent above normal rains in the southern states with a probability of about 90 per cent. It had said that the northeast (winter) monsoon, caused by retreating monsoon winds that attain moisture from the Bay of Bengal on their way back south from the northeastern direction, would be stronger. These winds are responsible for the rains in the southern states of Andhra Pradesh, Tamil Nadu, Kerala and parts of Karnataka between October and December. The IMD forecast though did little to prepare the states for the situation.

On December 1, 2015, an ill-prepared Tamil Nadu administration decided to open the gates of the Chembarambakkam reservoir, and the released water inundated the city. A public interest petition filed in the Madras High Court against the Tamil Nadu government suggests 1,104 cubic metres per second of water were released into the Adyar river, which meets the water requirements of the city. Highlighting how the decision was delayed, the petition, filed by Chennai-based businessperson Rajiv Rai, says that the water was released after a warning was issued at midnight. “If one studies the levels of water in the various catchment tanks on a daily basis, one can see that the reservoirs had much greater inflow than outflow right through November 2015,” says the petition. It alleges that state chief secretary K Gnanadesikan waited for three days after the Public Works Department (PWD) wrote to him on November 29 to release water from the reservoir. “The chief secretary, even though he was well aware of the reports that there was going to be heavy downpour for a few

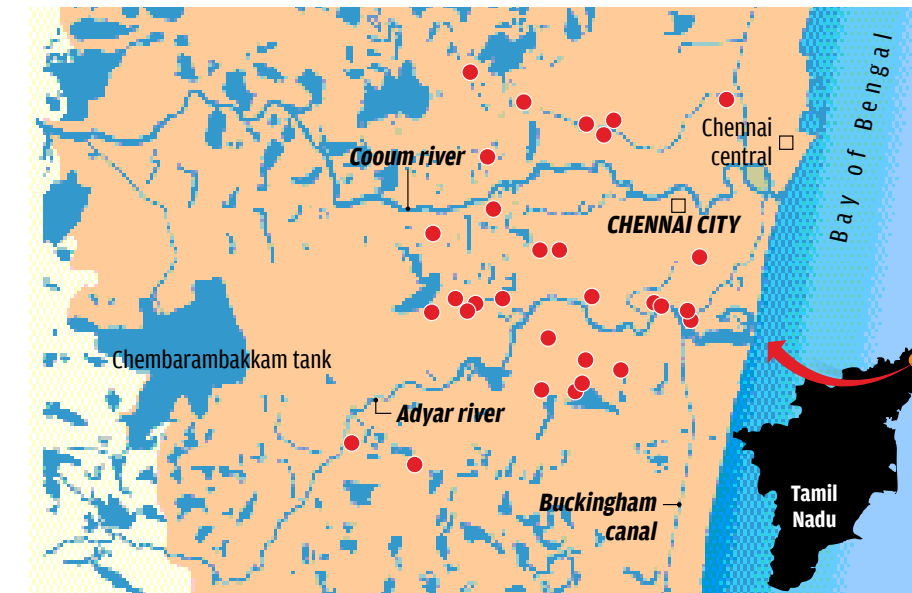
Flood water inside a residence at Adyar in Chennai on December 9, 2015



Chennai clogged

The city is flat and needs a very good drainage system. Flood-like situation was experienced in areas where water bodies have been encroached upon

● Areas affected by water logging



Source: chennaicorporation.gov.in, personal communication with Chennai corporation; Map not to scale

more days, didn't direct the release of water when he received the warning from PWD,” the petition says.

Clueless, yet confident

The administration was caught unawares despite the fact that floods are not new to the state. According to a 2013 Comptroller Auditor General of India (CAG) report, there have been 50 cyclonic storms in the region between 1900 and 2009. Even the hazard profiles of coastal districts prepared in the aftermath of the 2004 tsunami that hit the Tamil Nadu coast shows that most of the coastal districts experience flooding during the retreating monsoon, which normally accounts for 48 per cent of the rainfall in the state. “Heavy rains during the months of October, November and December inundate low-lying areas, coastal areas and the areas nearby major irrigation sources,” states the disaster profile prepared by the district administration.

The level of unpreparedness of the city administration can be gauged from the fact that the Chennai Metropolitan Development Authority (CMDA), the key urban planning agency for the city, still relies on outdated hazard profiles of Tamil Nadu, which says none of the areas in the state are flood-prone. According to CMDA's hazard profile document, “From the flood hazard map of India (mapped by IMD, New Delhi), it is seen that no area in Tamil Nadu falls in the risk zone.” The document says that few areas in Chennai might get flooded due to heavy storms and for this, flood affected areas have to be mapped.

The callousness of the state administration does not end here. The State

Disaster Management Authority, which was set up in 2008 under the Disaster Management Act, 2005, has not even met once, according to the 2013 CAG report. Close to seven years later, the state is yet to come up with disaster management rules. It was only in May 2015, following the Nepal earthquakes, the Municipal Corporation of Chennai started preparing a disaster management plan which predefines the roles of officials during a disaster.

Though the government repeatedly pointed out that the situation was unprecedented, the downpour exposed the state's inability to handle heavy rainfall. This should not have been the case because Chennai has been a pioneer among Indian cities as far as rainwater management is concerned. Having faced the severe drought of 1999-2000, the state government made rainwater harvesting (RWH) mandatory in all buildings in 2003. The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) took a number of steps to popularise RWH at the household as well as the community levels. Stormwater drains were provided with percolation pits to recharge underground aquifers with the runoff. Efforts were made to keep the water bodies in the city healthy to soak up the rainwater and recharge groundwater.

There are natural canals and drains that directly connect the city with wetlands, water bodies and rivers such as the Cooum and the Adyar that run through Chennai. The Cooum is supposed to collect surplus water from 75 tanks in its catchment area within the Chennai Metropolitan Area, while the Adyar is supposed to carry the surplus water of about 450 tanks in its catchment area and also from the Chembarambakkam tank which is not in its catchment (see 'Chennai clogged'). It was estimated that the city would harvest almost 129 million cubic metres of rain and recharge through different methods. Physiographically, Chennai is flat and needs a very good drainage system. A combination of natural and artificial drainage is the only way to protect Chennai from drought as well as floods. However, it seems that the government's efforts made have not been effective.

According to the Centre for Environmental and Water Resources Engineering, Chennai had more than 600 water bodies in the 1980s but a master plan published in 2008 said that only a fraction of the lakes could be found in healthy condition.

According to records of the state's Water Resources Department, the area of 19 major lakes has shrunk from a total of 1,130 hectares (ha) in the 1980s to nearly 645 ha in early 2000s, reducing their storage capacity, explains architect K Lavanya of Crescent School of Architecture, B S Abdur Rahman University, Chennai. Anil Kumar Gupta of the National Institute of Disaster Management (NIDM), New Delhi, says that there are over 30,000 slums on the banks of water bodies in these areas. The drains that carry surplus water from tanks to other wetlands are also encroached upon. A joint research paper by the department of physical geography, University of Freiburg, Germany, and Care Earth, India, shows that the Pallikaranai marsh, which is the major flood sink in the city, has been totally killed by buildings and roads that pass over it.

The human-made stormwater drains constructed to drain the flood water are



Taxi aggregator Ola launched a free boat service in flood-hit areas of Chennai

clogged and require immediate desiltation. The recharge pits constructed by CMWSSB along the drains also require maintenance and repair at some places.

According to a 2011 study by NIDM, Chennai has only 855 km of stormwater drains against 2,847 km of urban roads. Thus, even a marginally heavy rainfall causes havoc in the city. Moreover, the population of the city has grown eight times in the last century, according to NIDM. This has increased the runoff.

Monumental waste

The loss of water bodies, drainage systems and green areas show that the city has never given a serious thought to flood management. But the state government has spent huge amounts to clean up the rivers and rework its sewage infrastructure. A government-funded flood alleviation scheme was launched in 1998, at a cost of ₹300 crore, focused mainly on structural measures. Cleaning of certain waterways and lakes was also undertaken under the scheme. The Chennai City River Conservation Project was launched in 2000 to improve the waterways, with an estimated outlay of ₹1,700 crore. In 2009, the Union government allocated around ₹633 crore under the Jawaharlal Nehru National Urban Renewal Mission for Chennai to get its drains in shape. By 2014, about ₹394 crore were spent by Tamil Nadu. In 2014, the Comptroller and Auditor General of India noted that the state has not done enough to protect Chennai from floods and the plans made for flood control were flawed.

So what should be done? According to Delhi-based non-profit Centre for Science and Environment, urban planners should undertake a detailed mapping of water bodies, natural drainage and flood-prone areas in cities using remote sensing. And then integrate the drainage system of the city including rivers, rivulets, ponds, lakes and other natural drainage systems. The non-profit also suggests policymakers to relook the development plans approved by city authorities and find out whether they violate the hydrological cycle of the city. Finally, it calls for stronger laws to protect urban lakes. ■

Temple tanks hold key to water recharge

But authorities cement tank beds and fail to restore water inlet channels

The onset of the northeast winter monsoon over south India heralds the arrival of the float festival in Tamil Nadu, which is held just after rains cease. Idols of presiding temple deities are floated in the water tanks on rafts decked with flowers and flickering lamps. The tanks are usually attached to temples and occupy an important space in the state's cultural landscape.

But these tanks have another important role. "They are tools for recharging groundwater and absorbing floodwater," says Madhavi Ganesan, associate professor at the Centre for Water Resources in Anna University in Chennai.

Pammal tank restoration shows the way

The tank is 600 years old and the water in it was potable 35 years ago. Over the years, the inlets slowly got clogged; and the tank was also affected by siltation. S Indra Kumar says the depth of the tank decreased to 1.2 metre in 2000. Under ideal conditions, the depth should be about four metres.

In 2000, Kumar, a resident of the area, thought of reviving the tank. The tank was in bad shape, there were dead animals floating in it and raw sewage was entering the tank. Kumar approached the administration but failed to get funds from them although they promised support. Kumar then tried to revive the tank through the support of non-profit Exnora International. Local residents, schools and clubs also supported the programme financially. About ₹15 lakh was used to clean the tank spread over 2.6 hectare. Kumar explains that before

2000, the groundwater in the neighbourhood of the tank was highly polluted by the outflow from nearby tanneries. After the renovation of the tank, there is improvement in the quality of groundwater within five kilometres radius of the water body.

At present, Tamil Nadu has 2,359 temple tanks. Of these 55 per cent are in good condition, according to P Dhanapal, additional commissioner of the Hindu Religious and Charitable Endowments (HR & CE) Department, which monitors the tanks. Despite the monitoring, most tanks dry up in summer and a few are used to dump the city sewage, says S Indra Kumar, president of Home Exnora, a sister concern of Exnora International. Kumar had taken the initiative to revive the Pammal tank next to the Akkieswaran (Siva) temple in Kanchipuram district, 30 km from Chennai. The non-profit took the help of area residents in 2000. The revival of the tank has improved the quality of the groundwater within a five kilometre radius of the tank.

Needed: an action plan

The tank's revival can be a model for restoring other tanks in the state. The fund can be raised by HR & CE, municipalities, panchayats and private trustees, says Ganesan. She adds that the government has to prepare an action plan and decide on arranging funds raising. Another key concern about the tanks is their maintenance.

Most of the tanks had potable water a few decades back. But lack of awareness reduced many of them into garbage dumping sites, prone to encroachment. The inlets of the tanks, which carry rainwater from the surrounding catchment, are mostly clogged, making the tanks dry for most parts of the year. After few years, these dry tank beds become sites of development, explains Kumar. The most striking example is Thiruvallur district temple tank. The tank remained dry for many years and was converted into a parking lot by the administration.

Why tanks are drying

One of the obstacles in reviving these tanks is that the authorities focus on restoring the tanks only for the float festival, without looking at its water recharging potential. Residents dump garbage into temple tanks without realising they are a source of water for them. Ganesan adds that right now the inlets of the tanks are sealed off and they are merely used for storing water.

There are also schemes underway to put concrete in the base of the temple tanks, which will hamper water recharge. Ganesan says the bed material of tanks should be alluvial soil, which will help retain rainwater and at the same time recharge the groundwater in the surrounding area. A city like Chennai, which receives more than 1,200 mm of rain annually, can use these tanks as systems for harvesting rain. The rainwater that falls on the neighbouring catchment area can be diverted through inlet pipes to these tanks.

The average groundwater level in the water stressed areas of Chennai have dipped to 30-50 metres below ground. Restoring natural water tanks can go a long way in improving the city's ground water level and quality, says Ganesan. ■

Pammal tank in Kanchipuram district after restoration



SANVIKKA DASGUPTA

Getting the act right

So what do we know about urban floods. Firstly, they are one of the principal hazards in modern towns and cities and are capable of causing major economic losses and devastating social and environmental impacts. Secondly, unlike other types of flooding, urban flooding is a direct, quick and localised consequence of rainfall, making it difficult to predict. In fact, it often happens with little warning and in areas not normally prone to flooding. And thirdly, the biggest reason for this man-made disaster is unfettered urbanisation. This means that the higher the degree of urbanisation, the greater the threat and damage. A 2008 study by the National Institute of Disaster Management (NIDM) shows that the annual economic losses from urban flooding are much higher than those incurred from other disasters.

With this in mind, the National Disaster Management Authority (NDMA), the nodal agency to deal with natural disasters in the country, decided to deal with urban flooding separately. In 2001, the Ministry of Environment and Forests & Climate Change (MoEF&CC) developed a programme called the National Lake Conservation Project (NLCP) to conserve urban lakes. The salient feature of NLCP was that the cost of conservation will be shared by the Centre and states in 70:30 ratio. NLCP website says just 58 lakes have been identified from 14 states till 2012-13. It also states that ₹329.06 crore has been released by the Centre till March 2010 and 22 lakes have been revived. Hence, more needs to be done. In 2008, NDMA formed a committee on urban floods which formulated the National Guidelines for Management of Urban Flooding. The guidelines were released in 2010. Also, MoEF&CC issued a rule for conservation and management of wetlands in December, 2010, under the provisions of the Environment (Protection) Act, 1986, called the Wetlands (Management and Conservation) Rules, 2010. But the problem with both initiatives is that they are neither binding nor exhaustive in nature.

What the guidelines say

NDMA acknowledges the increasing frequency of urban flooding. It says that the causes of urban flooding are different for each city, which is why flood management strategies need to be customised. Policies for a coastal city, for example, would have to be different from a city located on the hills.

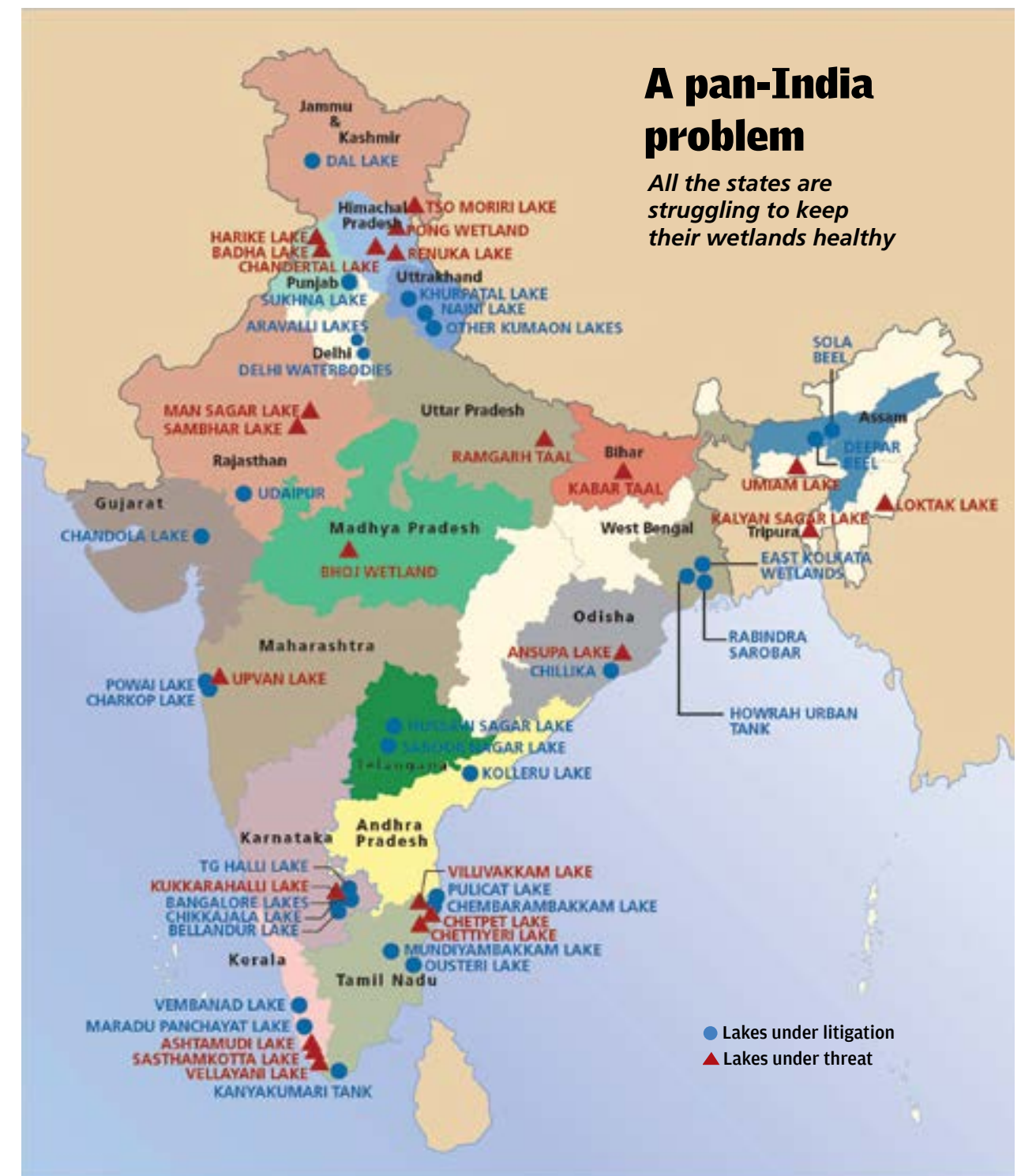
NDMA proposed an Urban Flooding Cell with a technical umbrella for forecasting and warning at the state level. It mooted a local network of automatic rainfall gauges for real-time monitoring. Local authorities were asked to go in for contour mapping, put the existing storm water drainage network on geographic information system (GIS) and desilt all drains by March end every year. It also suggested that lakes should be freed from encroachment so that the natural drainage system of a city could be maintained.

A lot remains to be desired

“But are the guidelines binding?” asks Arup Kumar Sarma of the Indian Institute of Technology (IIT), Guwahati, who was a member of the committee formed by

A pan-India problem

All the states are struggling to keep their wetlands healthy



NDMA. It is up to the states to implement the rules. The state governments are not “compelled” to follow the guidelines, so nothing ever happens, Sarma adds. He says there needs to be a holistic approach to address urban floods. “While preparing the guidelines, we had the diversity of India in mind and knew that the rainfall that Jaipur receives is not the same as what Shillong receives. So we tried to cater to all types of cities,” he explains.

He adds that for proper implementation of the guidelines, various departments have to come together. For example, the problem of urbanisation is not only wrong town planning but also encroachment of wetlands and water channels. To correct this, municipal corporations have to work closely with the irrigation and flood control departments. But administrative differences make it difficult to handle a disaster like urban flood.

This is evident from what happened in Srinagar in 2014. Despite repeated warnings by the irrigation and flood control departments about the encroachment of the drainage channels in the city, the Srinagar Municipal Corporation failed to clear these channels.

NDMA guidelines also stress on the need to make the planning process participatory. Following the hierarchical structure of administrative systems, flood control measures are planned without the participation of the affected communities. “In many cases, this results in unsustainable measures which don’t meet the needs of relevant stakeholders,” state the guidelines.

Lack of clarity

Lakes are at present under different departments including public health engineering, water supply, fisheries, irrigation, urban development, tourism and forests, public works department and forest and environment. Similarly the catchments are controlled and used by different agencies. The controlling and management agencies for the water bodies and their conflicting interests remain the main cause of degradation of water bodies. It has been seen that creation of a single apex authority in place of different lake owning agency is very essential. At present majority of the urban lakes and water bodies are under varying degrees of environmental degradation. The main causes for degradation being apathy of the different government departments and citizens. The process of restoration gets delayed because of the lack of understanding the ecology of the water bodies, conflict of interests between the land owning agencies and the stakeholders.

A balanced approach

In December 2013, Centre for Science and Environment (CSE), a Delhi-based policy-advocacy organisation drafted a Framework Legislation for Conservation and Protection of Wetlands in South Asia with the help of a legal firm (Enviro Legal Defence) and experts from different South Asian countries including India. Other countries involved were Nepal, Bangladesh, Pakistan and Sri Lanka. The CSE framework can be accessed at <http://goo.gl/Cor4JS>.

The main focus points of the draft are: decentralisation of management of the wetlands and use of technological advancement in conservation and protection of wetlands. These are completely missing in the existing wetland rule. The framework suggests a classification of critical wetlands for areas that are integral to sustaining environment and livelihoods of local communities.

The draft also suggests the constitution of authorities at three levels: central, state/provincial and district.

It provides various parameters for identification of wetlands, including geohydrological, area, size-circumference and volume specific, location specific (urban and non-urban) and nature specific (seasonal/perennial and critical/non-critical). Unlike the existing wetland rules, the draft talks about detailed mapping process that will involve the people, civil societies and scientific institutions. Mapping according to the draft will also record customary rights and management practices. A data bank should be created at the state level which should be created in a time bound manner and should be open to public.

While discussing permissible and prohibited activities, the draft is very clear that wetlands should not be leased to private companies. It has recognised the importance of trans-boundary and seasonal wetlands. The framework talks about the recognition of customary rights and management practices of wetlands and its nearby area. It introduces ideas of wetland conservation and management fund and incentive-based mechanisms to involve communities in conservation process. The draft also says that catchment areas and feeder channels should also be declared ecologically sensitive area.

Talking about punishments, it says penalty for an offence is to be compounded on the basis of value of damage to the wetland. The power of compounding the offence, according to the CSE draft, should be with the state and provincial government. The punishment should be up to three years and fine up to ₹100,000. Over and above this, the draft says that the offences should cognizable and non-bailable.

Lessons learnt

While most cities in India are yet to wake up to the problem of urban flooding, Guwahati, which faces floods almost every year, is getting ready with an action plan. The Guwahati Metropolitan Development Authority (GMDA) has taken up a project in the city’s Garbhanga hill for scientific management of rainwater that flows down the hill during monsoon, triggering landslides and choking drains with silt. Siltation in the drains by sediments carried by rainwater has been identified as one of the major causes of waterlogging in the city. GMDA also plans to clear encroachments along the drainage channels of Guwahati.

GMDA is being given technical support by IIT-Guwahati, and Shristie, a city-based civil engineering firm, which focuses on plantation in the hills, development of an efficient drainage system, putting up structures on the hill to check the speed of water and rainwater harvesting. The project is touted to be the first of its kind in India.

While some states have accepted that urban floods are becoming frequent, as are extreme weather events, and are taking steps to revive their natural drainage systems, others continue to be in denial. It is time state governments woke up to the crisis of urban floods and took adequate measures to preserve the ecological balance, while keeping contingency plans ready to deal with any unforeseen disaster. ■

CSE’s draft suggests the constitution of authorities at three levels: central, state/provincial and district

For proper implementation of the guidelines, various departments have to come together. But administrative differences make it difficult to handle urban floods

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CONTENTS